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The ReCaREDD project

Monitoring Forest Degradation in East Africa Status and Results

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MESA
Monitoring for Environment and Security in Africa

IGAD Climate Prediction and Applications Centre
ICPAC

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The ReCaREDD project

Monitoring Forest Degradation in East Africa – Status and Results

Results of Workshop on Forest Degradation Monitoring, Nairobi, 19-23rd October 2015

editors

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The ReCaREDD regional workshop for East Africa was held at the Regional Centre for Mapping of Resources for Development, Nairobi, 19th-23rd October 2015. Over 20 participants from 11 countries and local (Kenyan) institutions took part in the workshop – including training and practical sessions on processing and interpreting satellite images for forest monitoring.

The workshop was organised and presented by Hugh Eva, Fortunate Benda & Dario Simonetti

Training on JRC tools was given by Loren Hojas Gascón and Marcela Velasco

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Abstract

A workshop was held at RCMRD, the Regional Centre for Mapping of Resources for Development, Nairobi 19th -23rd October 2015 under the aegis of the ReCaREDD project, which is funded by DG DEVCO. Both RCMRD and their partner ICPAC have a long standing collaborations with the JRC are the main actors in the East Africa MESA project.

The workshop brought together a group of experts from partner countries of the East Africa to take part in a capacity building and information sharing workshop dedicated to reducing barriers for forest degradation monitoring in the tropics.

The participants, from 11 countries: *Burundi, Djibouti, Eretria, Ethiopia, Kenya (the host country), Rwanda, Somalia, Sudan, South Sudan, Uganda and Tanzania*; held discussions on methods, and reviewed data sources and tools for detecting and quantifying forest degradation using satellite data.

The JRC procured high resolution satellite data for test sites in each of the respective partner countries, which were processed and examined using the JRC in-house open source software (IMPACT).

During the workshop, partner countries provided information on the spatial localization, driving forces and magnitude of degradation processes in their respective countries. These data were entered into a GIS using the JRC IMPACT tool.

Using the JRC methodology the participants validated land cover change maps over the region so as to provide a statistical estimate of landcover change at four epochs – 1990, 2000, 2010 and 2015.

Topics covered in the workshop

- Degradation hotspots by country
- Review of potential satellite sensors for detecting forest degradation
- Review of methods for detecting and quantifying degradation with satellite data
- Country capacities for providing reference and current degradation activity data
- Interactive sessions on the JRC open source tool for working with satellite data
- Interactive review of high resolution RapidEye data
- Discussions on potential legends for classing degradation processes
- Review potential work program by JRC and partners for improving capacity for degradation monitoring

The principle results of the workshop

- A regional GIS showing the spatial distribution, magnitude and causes of forest degradation by country
- The current report, for each country outlining:
    - The state of the forests
    - Current capacities for monitoring forests
    - Drivers of deforestation
    - Institutional structures dealing with forests
- A preliminary assessment of deforestation and degradation for the region based a regular sampling grid of satellite data for 1990;2000;2010;2015
- Feedback on JRC open source software for satellite image processing and analysis

The institutes represented

Burundi	*Forestry Department, Ministry of Environment*
Eritrea	*Forestry Department, Ministry of Agriculture*
Ethiopia	*Ministry of Environment, Forest and Climate Change*
Djibouti	*Ministère de l'Habitat, de l'Urbanisme et de l'Environnement*
Kenya	*Kenya Forest Service*
	Kenya Forestry Research Institute
	Regional Centre for Mapping of Resources for Development (RCMRD)
	IGAD Climate Prediction and Applications Centre (ICPAC)
Rwanda	*Rwanda Natural Resources Authority*
South Sudan	*Ministry of Agriculture, Forestry, Cooperatives and Rural Development*
Sudan	*Forests National Corporation (FNC)-Sudan*
Somalia	*Ministry of Livestock, Forestry and Rangeland*
Tanzania	*Tanzania Forest Service*
Uganda	*Uganda National Forestry Authority*
	Makerere University

Country needs and capacities

Partner countries expressed a series of needs, which the JRC will attempt to meet under the project – however these needs are very diverse as capacities for monitoring forests in the region varying widely:

Partner countries can be tentatively split into four groups:

Group	***Infrastructure***	***Satellite data***	***Image processing***	***Resources***
A	*None-low*	*None*	*None*	*Few*
B	*Medium*	*Low*	*Some*	*Low - Few*
C	*Reasonable*	*Some*	*Some*	*Some*
D	*Good*	*Good*	*Fair*	*Some*

Depending on their group (see above) need and/ capacities are:

Group A:
Little basic infrastructure (computers and computer skills) to record and document land cover. Exploitation of satellite data at present is problematic.

Group B:
Not so much access to satellite data. Require support in mapping design and image processing techniques.

Group C:
Have capacities in the use of satellite data. However require upgrading of informatics, image processing capacities and training in methods.

Group D:
Support in mapping strategy and co-operation on best methods.

Forest monitoring results

Using a sample of 580 satellite image samples an estimate of the land cover change in the IGAD[1] and Tanzania region from 1990 to 2015 was undertaken. Over the 25 years covered by the survey the region has lost nearly 50,000 km^2 of tree cover, which corresponds to around 200,000 ha per year, a gross annual deforestation rate of 0.78%. Some 55% of the loss have been the conversion of forests to forest mosaics – a type of degradation, with 20% of forests becoming shrubs and 25% other land cover – predominantly agriculture.

Next steps

The ReCaREDD project continues to develop methods, software and improve access to satellite data for forest agencies in the tropics. In 2016 the project aims to:

- Provide access to Sentinel 2 data to partner institutions
- Run workshops in Central Africa for the Republic of Congo and the Democratic Republic of Congo and at Ispra for East and West African countries
- Run a field campaign for validating Sentinel data

[1] IGAD The Intergovernmental Authority on Development

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1. Introduction

Background

The ReCaREDD[2] project is hosted by the European Commission's Joint Research Centre, funded by the EU overseas cooperation service DG DEVCO. Its goal is to enhance the ability of institutions in partner countries to report on forest degradation, in a reliable and cost-efficient manner. Further objectives are to develop, share and adapt appropriate monitoring methods and to provide direct assessments of the status and evolution of tropical forest cover in support to forest policies and national and international negotiations on emission reductions. ICPAC and RCMRD are partners in the EU funded MESA (Monitoring Environment and Security in Africa) project, and therefore are the primary point of contract for ReCaREDD activities in East Africa.

In this framework the JRC is running a set of workshops to inform partner institutions and train them in techniques for monitoring and assessing forest degradation using remote sensing and field surveys.

Overview and Goals

ReCaREDD – To develop in partnership a strategy, guidelines and tools for exploiting Remotely Sensed data in conjunction with field measurement with the aim of detecting and quantifying forest degradation.

In the context of supporting forest monitoring in the East Africa region the workshop goals were to:

- Reinforce the capacity to process, interpret and extract data from satellite data
- Outline options and strategies for national forest agencies on how to monitor forest change – sample or wall to wall
- Review Global Forest Change product by country [3]

In the specific context of ReCaREDD

- Collect information for each of the partner countries on:
  - Locations of forest degradation
  - Drivers of degradation
  - Spatial and temporal nature of degradation
  - Select specific test sites for monitoring with satellite data
- Country presentations on current forest monitoring capacities – and where institutions such as the JRC and partners can help most
- Presentation of current FOROBS work on degradation monitoring
- Potential use of SENTINEL 2 data in the context of degradation monitoring
- Provide JRC software for processing of satellite data for land cover change monitoring

[2] ReCaREDD Reinforcing Capacities for REDD
[3] Found at http://earthenginepartners.appspot.com/science-2013-global-forest

Results

- Discussions on potential legends for classing degradation processes
-
- Review of potential satellite sensors for detecting forest degradation
- Review of methods for detecting and quantifying degradation with satellite data
- Country capacities for providing reference and current degradation activity data
- Interactive sessions on the JRC open source tool for working with satellite data
- Interactive review of high resolution RapidEye data
- Review national data sets produced from satellite data by JRC so as to derived regional deforestation and degradation estimates.
- Produce a GIS for showing degradation hotspots by country
- Review potential work program by JRC and partners for improving capacity for degradation monitoring

The rest of this report is divided into the following sections;

Section 2 – A synthesis of discussions on definitions and requirements;

Section 3 – The methods and results used to obtain regional forest change statistics;

Section 4 -A summary of country status, capacities and forest information;

Section 5 – Data provided to the countries;

.

2. Forest monitoring in East Africa: definitions and requirements

An initial roundtable was conducted to identify some of the underlying concepts that need to be adhered to if the implementation of the ReCaREDD goals is to be successful – suggestions were collated and definitions appear in Box 1. In Box 2 we present some of the guiding principles that can support a successful monitoring activity. A further discussion was held on "How to define forest degradation?"

DEFINITIONS

A clear definition of forest cover

As degradation is not a transition between classes, but a change within class, the forest definition needs to be clearly established. At the same time a realistic minimum mapping unit (MMU) must be applied. Some attempts to have very fine MMU have been tried so as to encourage community participation – however the logics of executing this and then harmonising the results are challenging.

Reference and monitoring epochs need to be established

A key element of monitoring will be to set the reference and monitoring periods. As degradation is a more subtle change than deforestation care is needed not to introduce errors of omission. This means that both the forest definition and the time epochs need to be realistic.

A classification scheme for degradation

Each forest service will need to establish a logical framework for quantifying degradation. Clearly, the most rigorous schemes will accurately quantify carbon loss. However, in an initial phase, it may be more realistic to envisage levels of degradation.

Box 1: Definitions for monitoring degradation

Requirements for Global Forest Change maps

The group of experts discussed whether the widely distributed Global Forest Change product from the University of Maryland was a potential requirement. There was a consensus that, while the products (satellite mosaics and forest change layers) are a major achievement and a valuable resource, they should not be seen as a source of country forest change estimates. The many different forest types and forest changes make it difficult for such a product to accurately report on forest changes globally.

The group also discussed the set of guiding principles that should be adhered to for successful implementation of forest monitoring in the region. These are summerised in box 2.

Multi-stakeholder agreement

The conception and implementation of the activities needs to have multi-stakeholder support.

Methods

Develop with partners, suitable methods to detect and quantify areas of degradation, following the definitions and accuracy requirements defined.

Sustainability

Institutional stability, financial support, technical independence will all be required to ensure that the process is sustainable.

Pragmatism

Methods need to be robust, and reproducible, with low complexity at both technical and institutional levels.

Definitions

Review existing national forest code so as to clearly define forest degradation and subsequently identify a set of criteria which can be highlighted by satellite imagery and be used to i) detect areas of degradation ii) quantify the area of degradation and iii) classify levels of degradation. Ensure that definitions are such that they can be compared to those proposed by other countries or institutions.

Tools

Identify how to best implement proposed methods in a sustainable, cost effective user-friendly environment, so as to lower the barriers to implementation.

Data

Facilitate access to appropriate remotely sensed data and derived products. Specifically facilitate access to raw data from Landsat and Sentinel 2. As a user group specify what derived products JRC could produce and disseminate (via Estation). Ensure that data produced is securely archived.

Expected results and accuracy

Review accuracy requirements and assess how the proposed methodology meets them. Clearly indicate what level of reliability will be reached with the methods adapted.

Integration

Ensure that the proposed work program builds on existing technical capacities, institutional capacities and knowledge (databases etc.). Ensure that different bodies, government departments, NGOs, international agencies etc., are aware and can participate at different levels.

Identify knowledge gaps

Review the full process so as to quickly identify areas where lack of techniques data and skills need to be addressed.

Identify institutional gaps

Assess whether the current institutional organization, mandate and resources are adequate to the implementation of the tasks

Transparency and Accessibility

A key concept is that all definitions, methods, results and accuracies are transparent. All products should be available and accessible to all partners, official institutions and the wider public.

Box 2: Requirements for monitoring degradation

3. Forest monitoring methods and results

3.1. Regional monitoring

At a meeting at the JRC in December 2013 a joint team of JRC and MESA forest officers determined a plan for regional forest mapping in East Africa, covering the IGAD member states. The road map consists of three parts.

i) Forest monitoring to provide IGAD with changes at the regional level via sampling
ii) Wall to wall monitoring of key forest land areas within each country
iii) Intensive monitoring a selected forest area within each country

Within this workshop, country representatives validated sample sites that were processed by the JRC and interpreted by MESA staff to meet the first objective above.

Methodology for providing harmonised statistics on the state and evolution of forest cover for the East Africa region - that is IGAD member states and Tanzania

A sampling approach: Regional based on the geographic 1 degree grid

i) Use of Landsat 8 data to map 10 by 10 km samples for 2014/2015
ii) Link to the historical data (1990, 2000, 2010) already available from TREES
iii) Involvement of National FS in validation and methods
iv) Identification of NF services wishing to carry out National inventory - technical assistance to formulate proposals will be provided IGAD and other players.

The processing chain at the JRC ingests the raw satellite data, cuts out the sample sites and segments and classifies the data for the four dates; 1990, 2000, 2010 and 2015. The national experts were asked to validate these classifications.

Tree Cover	*Trees greater than 5m and a cover of greater than 70%*
Tree Cover Mosaic	*Trees greater than 5m and a cover of between 40 and 70%*
Shrub Cover	*Woody cover less than 5m - can be tree regrowth*
Other Land Cover	*All non-woody land cover; grassland, baren, urban etc.*
Water	*Permanent water bodies*

Table 1: Land cover classification scheme used

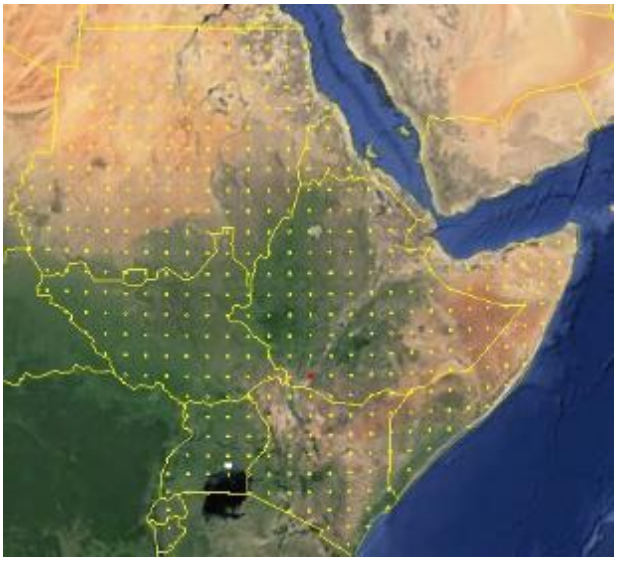


Figure 1: Sampling scheme over IGAD region

The JRC holds a database of satellite imagery for the sample and derived land cover classes and changes for the years 1990, 2000, 2010 sites based on the conjunction of the geographic grid. In conjunction with RCMRD, the JRC acquired imagery for the 2015.

The JRC pre-processed and pre-classified the data to land cover maps for the year 2015 using a simple classicisation scheme defined with the FAO (Table 1). These image classifications were then validated by national experts during the workshop. A segmentation process was used with a minimum mapping unit of 5 ha.

The steps in the processing are:

- Data selection- Figure 2
- Image pre-processing, segmentation and classification - Figure 3
- Classification validation and correction - Figure 4

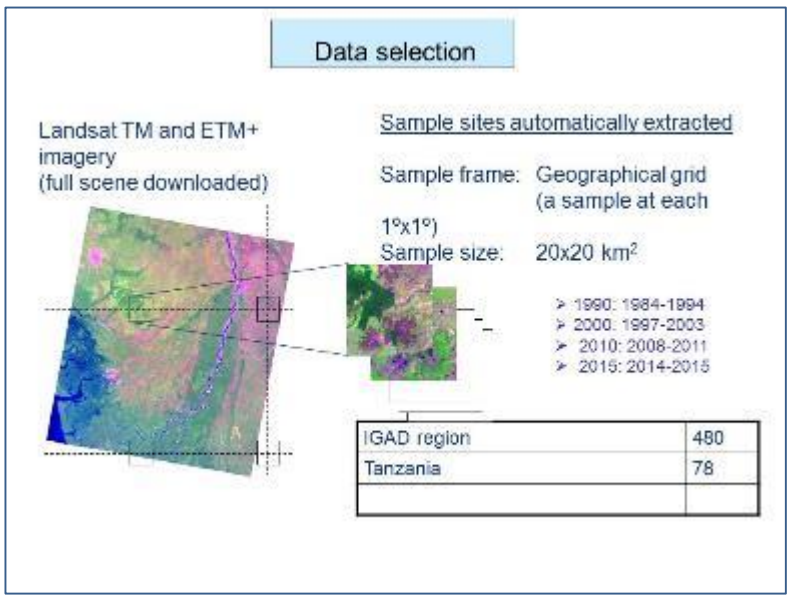


Figure 2: JRC image selection

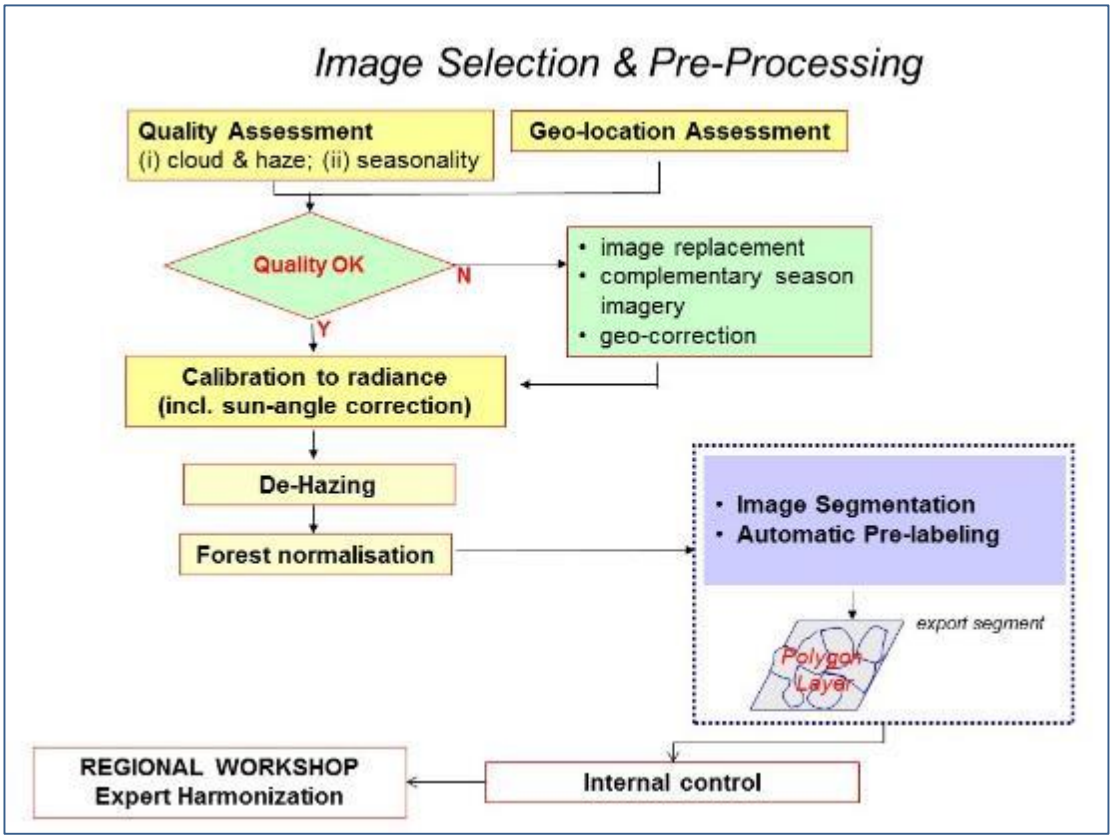


Figure 3: JRC Processing chain

The final classifications are then reviewed by the national experts to ensure quality control. This is carried out in the Validation Tool – developed by the JRC for this purpose.

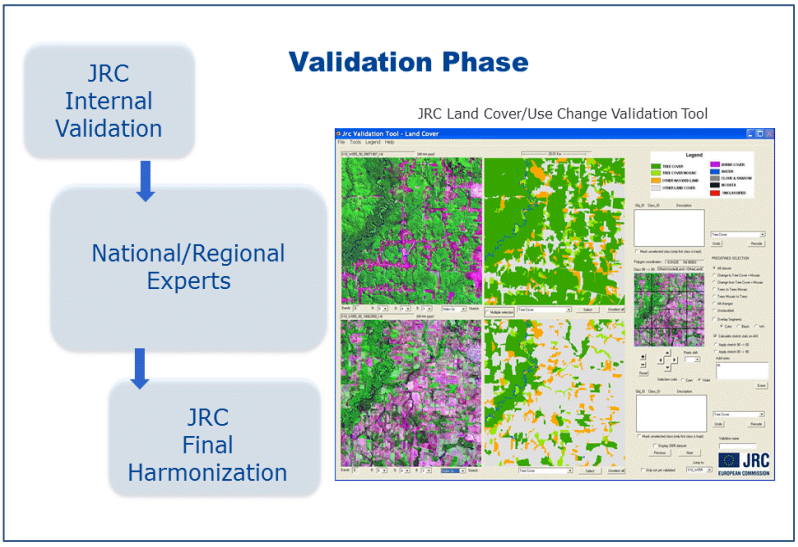


Figure 4: JRC Validation tool.

Once the classifications are checked, the class areas and transitions are extracted from the data and the class proportions used to estimate the land cover changes for the study area.

3.2. Regional forest monitoring results

Country statistics were provided for each of the major countries. At the same time countries provided a 'fact sheet' summarizing the institutional framework and status of the forests, along with a GIS highlighting the drivers of forest degradation at the department level. At the country level, caution should be used in the use of the statistics as the number of samples used for the individual countries are often too few to give robust results. At the regional level, however the 580 samples should give a reasonable estimation of the land cover dynamics (Figure 6).

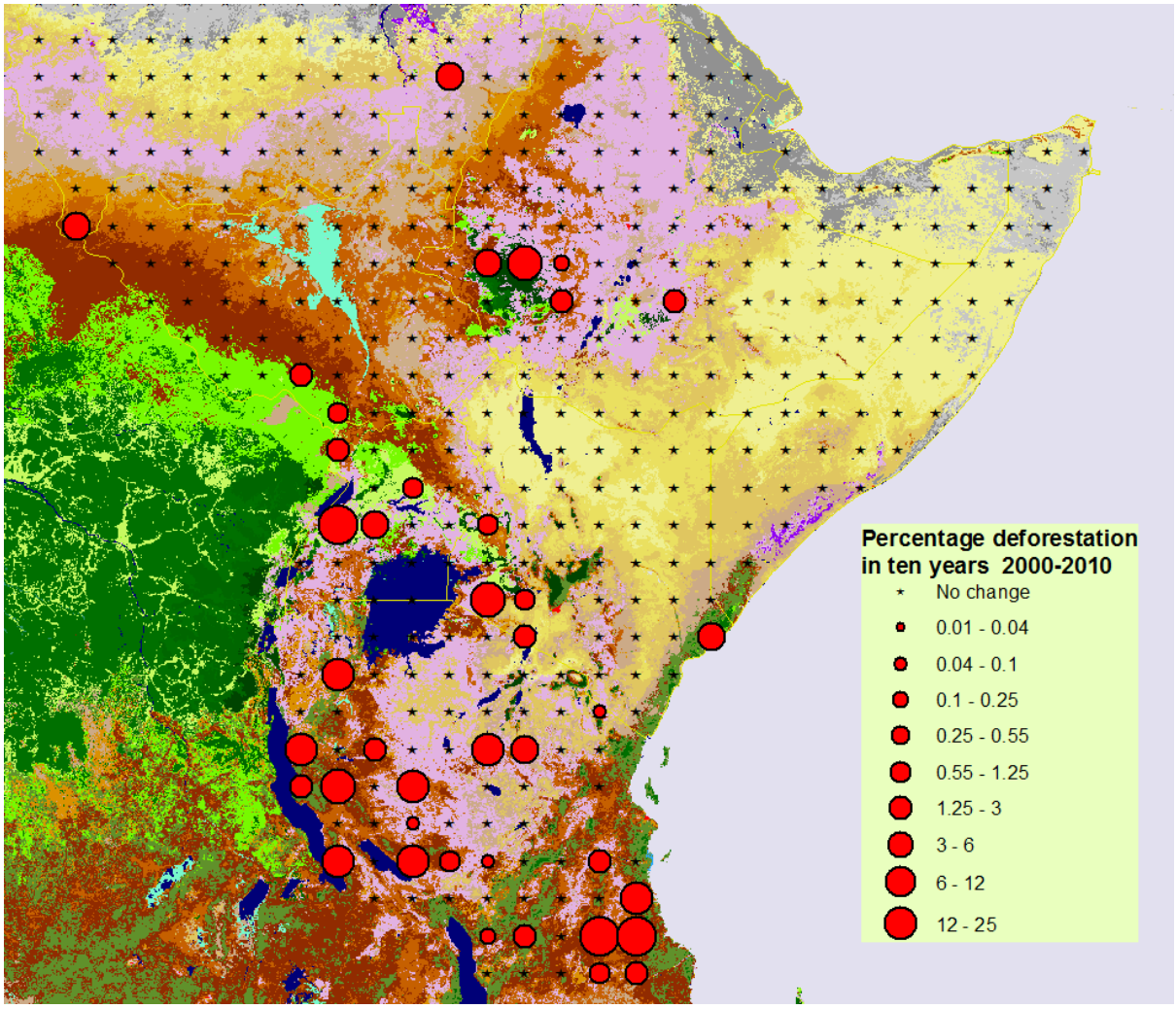


Figure 5: Sites with the highest forest cover change for the 2000 to 2010 period.

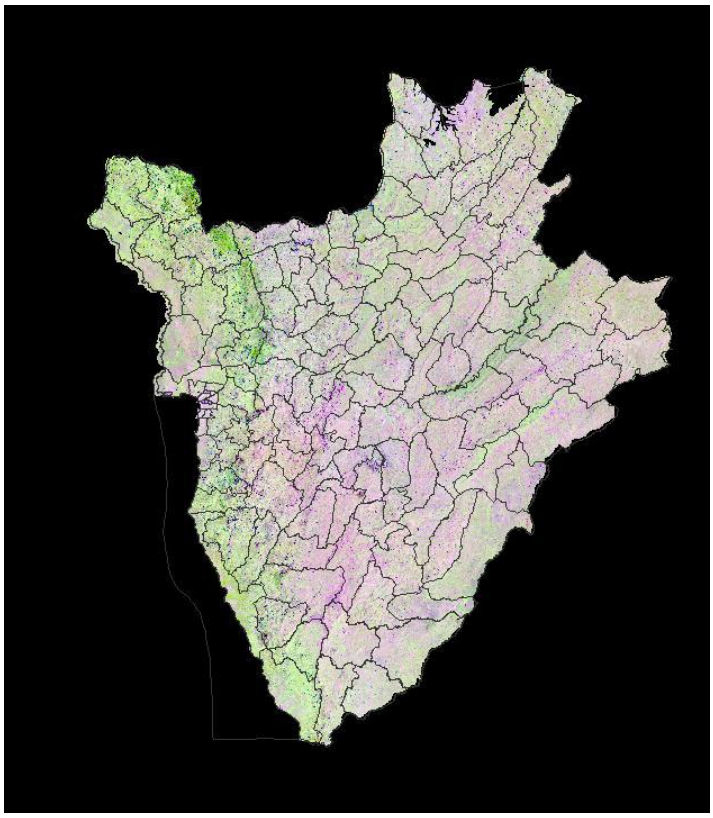
Over the 25 years covered by the survey the region has lost nearly 50,000 km^2 of tree cover, which corresponds to around 200,000 ha per year, a gross annual deforestation rate of 0.78%. Some 55% of the loss have been the conversion of forests to *forest mosaics* – a type of degradation, with 20% of forests becoming *shrubs* and 25% *other land cover* – predominantly agriculture.

Area in Square Kilometres			**1990/2000**			
	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 1990*
Tree Cover	257,220	14,624	3,438	3,971	-	279,289
Tree Cover Mosaic	3,800	353,493	14,758	7,746	-	379,842
Shrub Cover	604	6,931	1,994,648	35,920	-	2,038,387
Other Land Cover	501	2,098	19,159	3,233,019	829	3,255,606
Water	-	-	111	1,257	124,992	126,411
Total 2000	262,126	377,197	2,032,115	3,281,912	126,185	5,961,936
			2000/2010			
	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2000*
Tree Cover	230,660	15,893	6,048	9,526	-	262,128
Tree Cover Mosaic	2,902	349,204	12,392	12,690	-	377,194
Shrub Cover	-	3,864	1,998,181	29,581	-	2,032,131
Other Land Cover	116	1,018	11,366	3,268,744	-	3,281,898
Water	-	-	184	772	125,228	126,185
Total 2010	234,009	369,979	2,028,170	3,321,314	126,064	5,961,934
			2010/2015			
	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2010*
Tree Cover	227,528	2,625	1,915	1,938	-	234,007
Tree Cover Mosaic	1,417	360,675	3,997	3,876	-	369,978
Shrub Cover	-	1,506	2,012,316	14,089	-	2,028,173
Other Land Cover	676	2,619	19,068	3,298,633	-	3,321,315
Water	-	-	231	395	125,215	126,064
Total 2015	229,760	367,647	2,037,527	3,318,933	125,666	5,961,934

Figure 6: Land cover change matrix for the IGAD region and Tanzania

3.3. Forest monitoring by country

The JRC prepared country mosaics of satellite data. These consisted of 3 band Landsat mosaics, generated from the archive supplied on line by the University of Maryland on its Global Forest Change website[4]. Two dates are available 2014 and 2000. The recent, 2014 mosaic is of higher quality and was therefore used.



The country administrative boundaries were provided and overlaid on the satellite image. Using the JRC IMPACT tool, the participants were able to enter data on degradation processing into the vector layer, thus creating a GIS for each country. Participants felt that the administrative boundaries should be supplemented by a simple land cover classification.

Causes of degradation

Fire
Grazing
Fuelwood Harvesting
Logging - artisan
Logging - commercial
Urban
Shifting cultivation

Figure 7: Landsat mosaic of Burundi

[4] https://earthenginepartners.appspot.com/science-2013-global-forest

4. Country status, needs and fact sheets

A series of presentations were made by the participants on the current state of the forest by country and on the monitoring capacities of national institutions. The participants were provided with a template to aid in the structure of the presentations.

Oswald Ntakirutimana	*Burundi*
Mohamed Ahmed Djibril	*Djibouti*
Yonas Tekleab Aymut	*Eritrea*
Daniel Belay & Tariku Geda	*Ethiopia*
Rose A Akombo	*Kenya*
Anastase Nyandwi	*Rwanda*
Abdi Osman Ali	*Somalia*
Simon Dralley & Bronica Akol	*South Sudan*
Hanady Abdelgabbar & Safaa Ahamed	*Sudan*
Nurdin Chamuya & Jared Elly Otieno	*Tanzania*
John Diisi & John Bosco	*Uganda*

The following sections give an overview of the country status, a fact sheet and in most cases a map showing the main drivers of degradation and country forest change statistics derived from the analysis of a sample satellite images.

CAVEAT

Several considerations need to be employed when reviewing the country forest change matrices. The mapping exercise was undertaken to, provide regional statistics on forest change and to demonstrate the concept of monitoring using remote sensing data to the countries.

1/. The sample design for the analysis of these samples images, as described in section 3, was designed for regional monitoring statistics. Therefore, caution is needed in interpreting the results at the country level. For some countries, there are very few sample sites.

2/. The legend was designed to map forest changes at 10 year periods in the tropical zone. For the last period (2010-2015) reviewed, few changes are evident (or larger than the minimum mapping unit). This is due to the shorter period (in some cases only 4 years due to image availability).

3/. The scale of the changes in many landscapes were found to be smaller than can easily be picked up by 30m Landsat data.

4/. The TREES legend focuses on humid forests – this is not adequate to represent vegetation in the arid areas.

5/. For countries where forest is geographically highly concentrated (e.g. Ethiopia) the sampling will not adequately reflect changes.

The results by country, therefore have to be considered in this light.

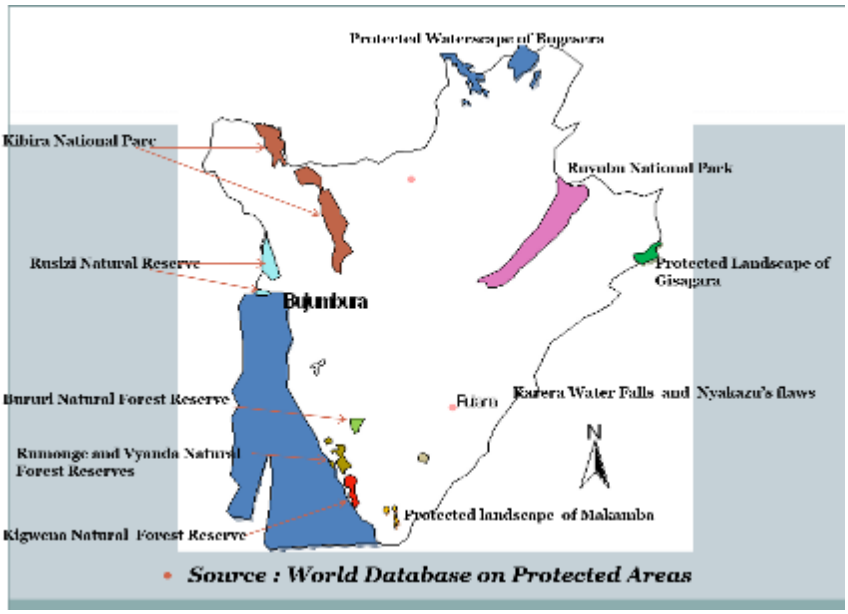
4.1. Burundi - Oswald Ntakirutimana

Burundi Forest Department

4.1.1. Overview

- **Forest definition:** Forest is a minimum area of land of 0.5 ha with tree crown cover (or equivalent stocking level) of more than 10-30 % with trees with the potential to reach a minimum height of 2-5 meters at maturity *in situ(Marrakech Accords,2011);* Forest includes natural forests and forest plantations. Forests are determined both by the presence of trees and the absence of other predominant land uses; the term includes forests used for purposes of production, protection, multiple-use or conservation (i.e. forest in national parks, nature reserves and other protected areas, or tree plantations on crests, etc.).
- **Deforestation** of the entire country is almost completely due to overpopulation; Forest cover decreased from 8% to 6% due to civil war (1993-2003).
- **The institutions** in charge of the forest sector were the Forest Department, and National Institute for Environment and Nature Conservation. Currently, a new office is in charge of environmental protection which is a result of a merger between the two institutions; one in charge of protected areas while the second was focused on plantation forests.
- **Burundi's lands** are mostly agricultural or pasture. Settlement by rural populations has led to deforestation, soil erosion and loss of habitats and biodiversity.
- **Forest protection**: The Burundi's government has made efforts in forest protection and biodiversity since the colonization period. When 3 protected areas were established: Kibira park, Bururi and Kigwena forest reserves. From then on, the country has initiated some implementations lows, politics and strategies related to forest protection and biodiversity preservation. Currently Burundi has 15 protected areas (nature reserves and parks) with cover of ± 157 923 ha estimated at 5, 6 % of the country. According to IUCN standards our protected areas are subdivided in 4 categories as follow: 3 NP, 5 NR, 2 NM and 5 PL.
- **The 3 main National Parks**: Kibira National Park (40 000 ha) to the northwest (a small region of rain forest, adjacent to Nyungwe Forest National Park in Rwanda); Ruvubu National Park (50 900 ha) to the northeast (along the Rurubu River), both were established in 1982 to conserve wildlife populations. Natural Reserve of Rusizi (5 932 ha) which is along Lake Tanganyika and Bujumbura capital city.
- **Deforestation and degradation drivers**: Main actors/factors: human activities; climate change; genetic degeneration. Direct causes. In Burundi all protected areas and their biodiversity are systematically degraded. The threats are both internal and external.

  They are mainly related to human actions such as: demographic high pressure; urban extension ; deforestation ; mining in the forest ; encroachment and cultivation ; poverty; bushfires; overgrazing; institutional capacity weakness (low, staff and budget); climate change.



Forest reserves in Burundi

The government is engaged to restore, protect and promote forests. This will help to contribute to climate change mitigation and adaptation through some measures and initiatives such as:

- To update the statutory texts on protected areas and grant to the entire network's protected areas;
- Strengthen partnership with key stakeholders (different ministries, NGOs, local administration and communities);
- Improve agricultural practices;
- To develop and implement the forest management plans;
- Increase forest cover;
- Involve local communities in sustainable management of the forest and promote some initiatives which can provide income to them (ecotourism, bee keeping, etc.);
- Ensure the capacity building of field staff.

Capacity	Remote Sensing	GIS	Inventory
Basic information	Bad	Bad	Medium
Technical capacities	Bad	Bad	Medium
Human resources for field inventory – skills and material	Bad	Bad	Medium
Human resources for analysing data	Bad	Bad	Medium
Software and computer resources	Bad	Bad	Medium

4.1.2. Country Fact Sheet

Country Fact Sheet	Burundi
Institution	Forest Department under Burundian Office for Environment Protection
Other institutions involved in forest monitoring	Academic institution and NGOs
Specify type (Government / Research etc)	Government, Academic institution and NGOs
Mandate of your institution	✓ Environment protection and biodiversity and natural habitats conservation ✓ Ensure the implementation of the environment standards ✓ Ensure compliance of the law in matters of environment protect(forest and environment acts and its applications texts ✓ Establish mechanism of climate mitigation and adaptation ✓ Identify and Extend protected areas ✓ Increase forest cover ✓ Ensure monitoring of forest and environmental dynamic
Institutional strengths	✓ Updating lows process; ✓ Reducing of the institutional interferences ✓ Human resources ✓ Partnership
Institutional weaknesses Specify : legal, technical , financial	
At legal level	lack of updated laws : ✓ The forest act is in review process ✓ The environment act is dated from 2000 while the environment aspects are very dynamic
At technical level	✓ Professional field staff not enough ✓ lack of the adequate equipment and capacity building
At financial level	Allocation budget not enough
Specific areas to be addressed	✓ Updating data and forest and environment statutory texts ✓ Improve the forest management plans ✓ Involve people in wise use of the natural resources and environment protects ✓ Ensure n staff capacity building ✓ Provide adequate equipment ✓ Strengthen and maintain partnership
Structural Capacity for:	
Field survey	Staff exist but luck of the equipment such as GPS, etc
Remote Sensing	No existing structure
GIS	No existing structure
Current RS data available	No data
Specify data source , coverage , dates	-
Forest inventory data and maps	
Dates; coverage – regional , national	1985, at the national level

• Forest types and distribution	✓ Rain forest (1600-2600m) ✓ Medium altitude Forest (1000-1600m) ✓ Forestry Galleries (☐1300m) ✓ Savana ✓ Xerophilous thickets ✓ Mesophilic perished Guinean forests (775-1000m)
• Forest protection	✓ Measures to reduce threats by making forest demarcation and restoration ✓ sensitization cessions ✓ management plans process ✓ participatory approaches
• Forest change (deforestation)	All forests are affected(naturals protected areas and plantations)
• Forest change (degradation)	All forests are affected(naturals protected areas and plantations
• Main threats	➢ Demographic high pressure; ➢ Urban expansion; ➢ Deforestation ; ➢ Mining in the forest ; ➢ Encroachment and cultivation ; ➢ Poverty; ➢ Firebush; ➢ Overgrazing; ➢ Institutional capacity weakness (low, staff and budget); ➢ Climate change;
Current REDD initiatives In the country	✓ Forest cover extend ✓ Sensitization sessions ✓ Initiation of on law on REDD+
Other initiatives	✓ Increase forest cover ✓ Update forest and environment statutory texts ✓ Strengthen partnership ✓ REDD+ initiatives ✓ Climate change adaption and mitigation approaches
Main types of forest degradation	✓ Biomass reduction ✓ Unproductive forest ✓ Biodiversity reduction ✓ Soil erosion ✓ Socio economics and environmental impacts
Driving forces	✓ Updating lows process; ✓ Reducing of the institutional interferences ✓ Human resources ✓ participatory approaches ✓ Partnership
Current locations of forest degradation	
Location	All protected areas are affected and out of them
Source (logging / firewood etc,)	Over logging , firewood, cultivation, climate change, overgrazing
Requirements for improving capacity Software , images, methodology	Capacity building in : ✓ Institutional level (staff); ✓ Adequate and enough equipment; ✓ Financial for implementation
Recommendations for the workshop	✓ Provide enough skills for RS and mapping methods ✓ Implements the recommendations according the respective country needs

4.1. Djibouti - Mohamed Ahmed Djibril

Ministère de l'Habitat, de l'Urbanisme et de l'Environnement

4.1.1. Country Fact Sheet

Country	**Djibouti**
Institution	Ministère de l'environnement de Djibouti
Other institutions involved in forest monitoring	
Specify type (Government / Research etc).	Government
Mandate of your institution	Protection of environment
Institutional strengths	Protection of biodiversity
Institutional weaknesses	
Specify (legal, technical , financial)	Technical
Specific areas to be addressed	Forest of Day and Mangroves
Structural Capacity for:	
Field survey	medium
Remote Sensing	weak
GIS	weak
Current RS data available	Amesd antenna (Spot vegetation, ..)
Specify data source , coverage , dates	Amesd, since 2012
Forest inventory data and maps	1990
Dates; coverage – regional , national	regional
How were they produced?	Spot images
Review of forest information	
Forest types and distribution;	Juniperus procera, Avicena marina rhyzophora
Forest protection	Protected areas
Forest change (deforestation)	strong
Forest change (degradation)	strong
Main threats	Cattles overgrazing and deforestation
Current REDD initiatives In the country	None
Other initiatives	Unep

Main types of forest degradation	Human and animals
Driving forces	
Current locations of forest degradation	
Location	Day, 11º43´et 11º48´N et entre 42º38´et 42º44´E
Source (logging / firewood etc,)	logging
Requirements for improving capacity Software , images, methodology	Satellite acquisition (height resolution) , training course, creation of remote sensing laboratory
Recommendations for the workshop	Information for the acquisition dates and treatments

4.1.2. GIS of disturbances

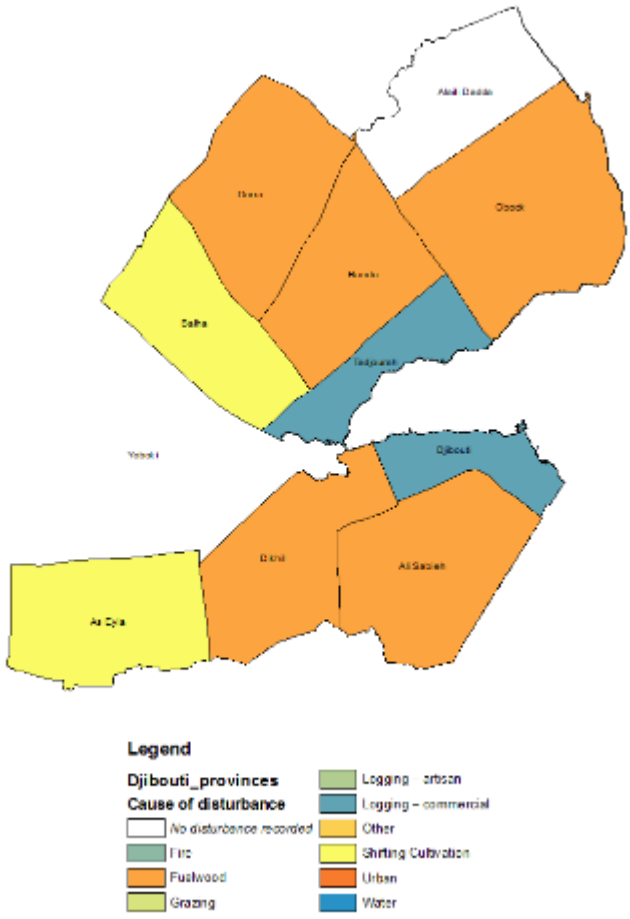


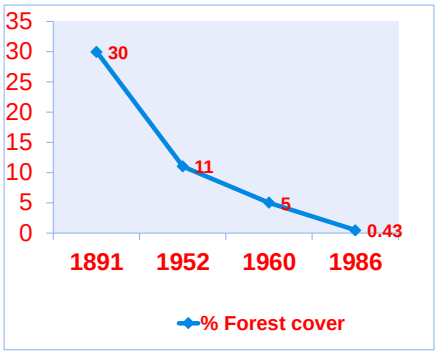
Figure 8: GIS for Djibouti

4.2. Eritrea - Yonas Tekleab

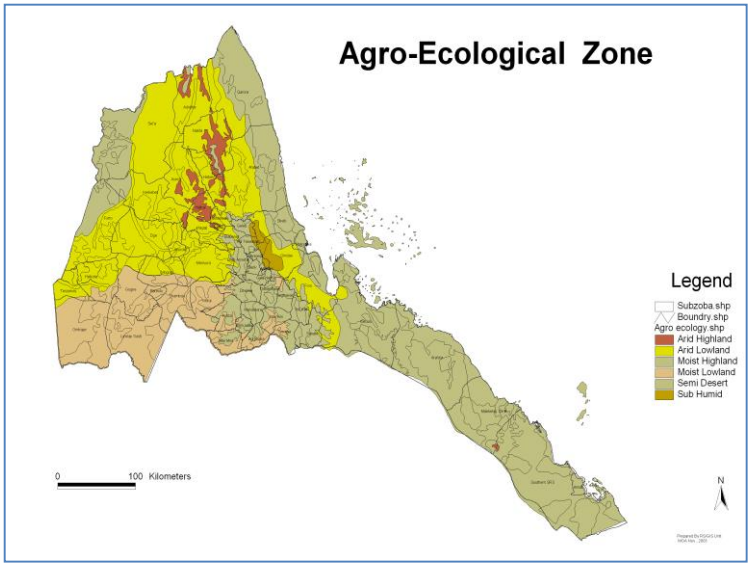
Forestry and Wildlife Authority, Ministry of Agriculture

4.2.1. Overview

- **Forest definition:** Forestland is defined as land areas that have a tree-crown areal density (crown closure percentage) of 10 percent or more, are stocked with trees capable of producing timber or other wood/non wood products.
- **Deforestation**. Forest cover is estimated to have fallen from 30% of the entire country in 1891 to just 0.43% in 1986.



- **The institutions** involved in forest monitoring and management: Forestry and Wildlife Authority, Ministry of agriculture, Ministry of Land, Water and environment, Ministry of Local Government, CBOS (Eritrean Youth and Students, Eritrean women Association. etc.).
- **The dominant vegetation types** include: acacia bushland and shrubland, savanna woodland, some disturbed forests with *juniperus procera* and *olea africana*, scattered woodland (*Hyphenae* palm along major rivers), sparse scrub, grass and halophytic communities (*Acacia mellifera*), some mangrove species along the coast of the Red Sea.



- **Eritrea's lands** are mostly grazing and browsing lands (49.2%) but a large proportion is classed as 'unsuitable' (33.14%).
- **Deforestation and degradation drivers**: Main actors are investors in commercial farming, traders, communities, herders. Degradation has been brought on by unsuitable forest use and expansion of agricultural land, Fuel wood consumption/no alternative source of energy, war, construction of traditional houses, population pressure, drought and rainfall patterns, erosion and natural disasters.
- **The consequences of deforestation and degradation** have been that fuel wood has become an expensive commodity. Trees have become so rare that animals suffer from lack of appropriate habitat. Range lands are losing their meaning. Good soils are losing their productive capacity, springs and rivers are drying up. Biodiversity is constantly in decline. Siltation of dams and ponds, dumping of fertile lands. Desertification has contributed significantly to climate change, thus drought becomes common phenomena.
- **The Forest and Wildlife department** are providing guidance, training and services for the conservation development & sustainable utilization for forest and wild life resources of the country and there are a number of endeavours to mitigate the effects of deforestation and degradation:
  - Afforestation and Reforestation;
  - Soil and water conservation;
  - Protecting & enhancement of Biodiversity;
  - Awareness raising.

Capacity	Remote Sensing	GIS	Inventory
Basic information	Bad	Medium	Bad
Technical capacities	Bad	Bad	Bad
Human resources for field inventory – skills and material	Bad	Medium	Bad
Human resources for analysing data	Bad	Bad	Bad
Software and computer resources	Bad	Bad	Bad

.....

4.3.2. GIS of disturbances

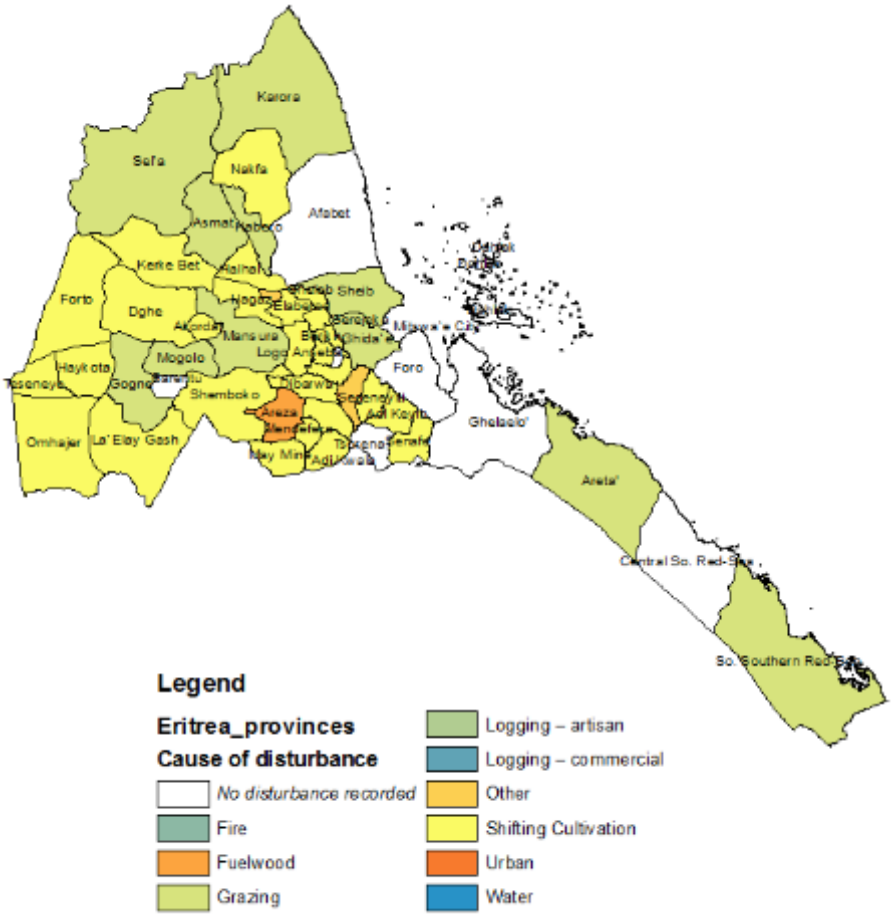


Figure 9: GIS for Eritrea

Statistics and country profile were not available for Eritrea.

4.3. Ethiopia - Daniel Belay & Tariku Geda

Ministry of Environment, Forest and Climate Change

4.3.1. Overview

- **Forest definition:** 'Land spanning more than 0.5 ha covered by trees (including bamboo) (with a minimum width of 20m or not more than two-thirds of its length) attaining a height of more than 2m and a canopy cover of more than 20% or trees with the potential to reach these thresholds in situ in due course'. However, for Forest Land considerations for EMA-RCMRD LULC we consider, 0.5 ha, 2m height, 10% canopy, and a tree dbh of 5 cm.

- **Deforestation**. The deforestation rate is around 1–1.5 % percent of the country annually.
- Forest trends: 2003 12,577,228 ha; 2008 15,413,856 ha; 2013 18,561, 698 ha

- **The institutions** involved in forest monitoring and management: Government : Ministry of Environment, Forest and Climate Change, Ministry of Agriculture and Natural Resources Management, Ethiopian Institute of Biodiversity, Ethiopian Institute of Environment and Forest Research , Ethiopian Wildlife Conservation Agency, in Oromia Region State- Oromia Forest and Wildlife Enterprise, in Amhara Regional State- Amhara Forest Enterprise. Non-Government: Farm Africa, World Vision Ethiopia, SOS Sahel Ethiopia, etc. Civil Society: Forum for Environment, Melka Mahiber, Ethiopian Forest Society, etc.

- **The forest classification is determined by cover:** Dense Forest = >80%; Moderate Forest = 40 – 79%: Sparse Forest = 20 – 39% - following EMA-Ethiopian Mapping Agency-RCMRD LULC scheme.
-
- **Deforestation and degradation drivers**: Human induced forest fires conversion of forests to agricultural land, and unsustainable fuel wood consumption. Human encroachments **-** illegal logging and timber producers along with illegal settlers.

- **Technical needs for monitoring deforestation and degradation:** Strengthen the capacity of the Ministry through training on how to conduct field survey and manipulate field survey equipment. Establish RS and GIS based Information Centre and provide series of training on the selected topic to build the capacity of the Ministry.

Capacity	Remote Sensing	GIS	Inventory
Basic information	Medium	Good	Good
Technical capacities	Good	Good	Good
Human resources for field inventory – skills and material	Good	Good	Good
Human resources for analyzing data	Medium	Medium	Medium
Software and computer resources	Medium	Medium	Medium

4.3.2. Country fact sheet

Country Fact Sheet	**Ethiopia**
Institution	Federal Democratic Republic of Ethiopia Ministry of Environment, Forest and Climate Change.
Other institutions involved in forest monitoring. Specify type (Government / Research etc).	**Government :** Ministry of Agriculture and Natural Resources Management, Ethiopian Institute of Biodiversity, Ethiopian Institute of Environment and Forest Research , Ethiopian Wildlife Conservation Agency, Oromia Wildlife and Forest Enterprise, Amhara Forest Enterprise **Non-Government:** Farm Africa, World Vision Ethiopia , SOS Sahel Ethiopia **Civil Society:** Forum for Environment, Melka Mahiber, Ethiopian Forest Society
Mandate of the Ministry	a. Coordinate measure to ensure that the environmental objectives provided under the Constitution and the basic principles set out in the environmental police of Ethiopia are realized;
	b. Establish a system for environmental impact assessment of public and private projects , as well as social and economic development policies, strategies, laws and programs;
	c. Prepare a mechanism that promotes social, economic and environmental justice and channel the major part of any benefit derived thereof to the affected communities to reduce emissions of greenhouse gases that would otherwise have resulted from deforestation and forest degradation;
	d. Coordinate actions on soliciting the resources required for building a climate resilient green economy in all sectors and at all governance levels as well as provide capacity building support and advisory services;
	e. Establish a system for the evaluation of the environmental impact assessment of investment projects submitted by their respective proponents by the concerned sectorial licensing organ or the concerned regional organ prior to granting a permission for their implementation in accordance with the environmental impact assessment Proclamation;
	f. Prepare programmes and directives for the synergistic implementation and follow up of environmental agreements ratified by Ethiopia pertaining to the natural resources base, desertification, forests, hazardous chemicals, industrial wastes and anthropogenic environmental hazards with the objective of avoiding overlaps, wastage of resource and gaps during their implementation in all sectors

Country Fact Sheet	Ethiopia
	and at all governance levels;
	g. Take part in the negotiations of international environmental agreements and, as appropriate, initiate a process of their ratification;
	h. Formulate or initiate and coordinate the formulation of polices, strategies, laws and programs to implement international environmental agreements to which Ethiopia is a party and upon approval, ensure their implementation;
	i. Formulate environmental safety policies and laws on the production, management and utilization of hazardous substances or wastes, as well as on the development of genetically modified and alien species, and ensure their implementation;
	j. Prepare or cause the preparation of environmental cost benefit analysis and formulate an accounting system to be used in development plans and investment programs and, as the case may be, monitor their application;
	k. Propose incentives or disincentives to discourage practices that may hamper the sustainable use of natural resources or the prevention of environmental degradation or pollution;
	l. Establish an environmental information system that promotes efficiency in environmental data collection management and use;
	m. Coordinate, and as may be appropriate carry out, research and technology transfer activities that promotes the sustainability of the environment and the conservation and use of forest as well as equitable sharing of benefits accruing from them while creating opportunities for green jobs;
	n. In accordance with the provision of the relevant laws, enter any land , premises or any other place that falls under the federal jurisdiction, inspect anything and take samples as deemed necessary with a view to discharging its duty and ascertaining compliance with the requirements of environmental protection and conservation of forest;
	o. Prepare and disseminate a periodic report on the state of the country's environment and forest as well as climate resilient green economy;
	p. Promote and provide non-formal environmental education programs, and cooperate with the competent organs with a view to integrating environmental concerns in the regular educational curricula.
	q. Coordinate measure to ensure that the environmental objectives provided under the Constitution and the basic principles set out in the environmental police of Ethiopia are realized;

Country Fact Sheet	Ethiopia
	r. Establish a system for environmental impact assessment of public and private projects , as well as social and economic development policies, strategies, laws and programs;
	s. Prepare a mechanism that promotes social, economic and environmental justice and channel the major part of any benefit derived thereof to the affected communities to reduce emissions of greenhouse gases that would otherwise have resulted from deforestation and forest degradation;
	t. Coordinate actions on soliciting the resources required for building a climate resilient green economy in all sectors and at all governance levels as well as provide capacity building support and advisory services;
	u. Establish a system for the evaluation of the environmental impact assessment of investment projects submitted by their respective proponents by the concerned sectorial licensing organ or the concerned regional organ prior to granting a permission for their implementation in accordance with the environmental impact assessment Proclamation;
	v. Prepare programmes and directives for the synergistic implementation and follow up of environmental agreements ratified by Ethiopia pertaining to the natural resources base, desertification, forests, hazardous chemicals, industrial wastes and anthropogenic environmental hazards with the objective of avoiding overlaps, wastage of resource and gaps during their implementation in all sectors and at all governance levels;
	w. Take part in the negotiations of international environmental agreements and, as appropriate, initiate a process of their ratification;
	x. Formulate or initiate and coordinate the formulation of polices, strategies, laws and programs to implement international environmental agreements to which Ethiopia is a party and upon approval, ensure their implementation;
	y. Formulate environmental safety policies and laws on the production, management and utilization of hazardous substances or wastes, as well as on the development of genetically modified and alien species, and ensure their implementation;
	z. Prepare or cause the preparation of environmental cost benefit analysis and formulate an accounting system to be used in development plans and investment programs and, as the case may be, monitor their application;
Institutional strengths	Ministry of Environment, Forest and Climate Change is a young Ministry with 2years and 3months age. It was established 29th day of July,

Country Fact Sheet	Ethiopia
	2013. However it shares experience from former Ethiopian Environmental Protection Authority (EPA) as well as Ministry of Agriculture and Natural Resources (MoANR). Before the Ministry was established the forest sector was under Ministry of Agriculture and Natural Resources (MoANR) at team level (not more than ten forest experts). But now the Ministry has more than 300 staffs at Ministry level and many more at the regional level-the second administrative level in Ethiopia-. All the forest cases and responsibility from MoANR was transferred to the former EPA, and then Ministry of Environment, Forest and Climate Change was established. Having this under consideration, there different initiatives are undergoing and coordinating with the Ministry. For instance the ongoing efforts to reduce deforestation and forest degradation have made significant contribution in restoring and enhancing the capacity of forest ecosystem to provide goods and services for socio-economic development. A huge community mobilization for tree planting campaign annually during the rainy season has been conducted through the Ministry coordination.
Institutional weaknesses	MEF hasn't established its institutional setup up to "Kebele" level – a grass root level/the lowest administrative unite in Ethiopian-. It has no well-established and functional IT infrastructure as well as lack of adequate RS and GIS laboratory. The forest resources data at the country level has been collected manually through the undergoing National Forest Inventory (NFI) since March 2014. Although the inventory assisted with Remote Sensing and GIS technology, the Ministry is not able to implement this modern technology in its full potential.
Specify (legal, technical , financial)	**Legal:** Inadequate enforcement of existing forest and environmental laws. **Technical:** Inadequate skilled staff in RS and GIS.

Country Fact Sheet	Ethiopia
	Financial: Insufficient financial resources for large scale forest sector investment, particularly for the existing forest enterprises.
Specific areas to be addressed	- **Establish Environment, Forest and Climate Change information centre:** give priority on the strengthen of Decision Support System (DSS) - geospatial techniques assisted methodologies that help mainstream the technical, regulatory, institutional and financial requirements of sustainability into policies, strategies, programs, plans, laws and projects. - Strengthen the technical and financial capacity of the Ministry to map the land use land cover and forest resource change detection, land suitability analysis for forest investment. - How to prepare and the methodologies needed for quantification and demonstration of the multiple contributions forest ecosystem goods and services to the GDP, so that it will be possible takes informed decision.
Structural Capacity for:	
Field survey	Strengthen the capacity of the Ministry: through training how to manipulate field survey equipment.
Remote Sensing	Establish RS and GIS laboratory and series of training on the selected topics to build the capacity of its staff.
GIS	Establish GIS based Information Centre and provide series of training on the selected topic to build the capacity of its staff. This will increase the Government's capacities and strengthen its institutions to manage its National Forest Management and MRV system and update regularly its various components.
Current RS data available	Satellite imagery
Specify data source , coverage , dates	Land sat 8, full country year 2013.
Forest inventory data and maps	The study is undergoing by National REDD+ Secretariat of Ethiopia through FAO technical assistance (for recent data).
Dates; coverage – regional , national	Since March 2014, National forest resources Assessment.
How were they produced?	The sampling design adopted for NFMA is systematic. Sampling units (SU) are selected at least at the intersection of every degree of the latitude/longitude grid. Stratification was adopted in situations where stable strata such as ecological zones are deemed to improve the design. The number of sampling unit (SU) or tracts to be surveyed were determined by the available financial and human resources for the assessment, and with a view to enabling periodic monitoring.

Country Fact Sheet	Ethiopia
	Data has been collected in the field through observations, measurements and interviews at different levels.
Review of forest information	
Forest types and distribution;	
Forest protection	Government-controlled forest conservation initiatives began in Ethiopia in the mid-1970s. These initiatives have resulted in the establishment of different types of protected areas such as state-owned Forest Priority Areas (FPAs), National Parks, Game Reserves, Sanctuaries and Controlled Hunting Areas. Areas that are designated as National Forest Priority Areas have as principal objective to protect and conserve biodiversity. However, NFPAs are reported to be neglected and degraded due to agricultural conversion and uncontrolled harvesting practices. Sometimes there are not even enough resources to demarcate and gazette the forests. However, in protected areas where the PFM projects and customary management systems still exist; there are notable exceptions where the local people are actually investing in the protection of these forests.
Forest change (deforestation)	The study is undergoing by National REDD+ Secretariat of Ethiopia
Forest change (degradation)	The study is undergoing by National REDD+ Secretariat of Ethiopia
Main threats	Forest fire, diseases , illegal encroachment
Current REDD initiatives In the country	Ethiopia is a REDD+ participant country in the Forest Carbon Partnership Facility (FCPF) of the world bank. Unlike most REDD+ countries, REDD+ in Ethiopia is an integral part of a bigger climate resilient green economy (CRGE). Ethiopia's strategy provides targets for reducing emissions and increasing climate resilience in 8 key sectors and compliments the country ambitious Growth and Transformation Plan (GTP, 2010/11-2014/15 and 2015/16-2019/20). Ethiopia's REDD+ readiness phase was launched in January 2013 and is expected to be completed in June 2016. A national REDD+ Secretariat is spearheading the readiness process. Ethiopia's REDD+ program is being financed by the Royal Norwegian Government and the United Kingdom through the World Bank serving as a trustee (Readiness fund).

Country Fact Sheet	**Ethiopia**
Other initiatives	National level Tree based landscape restoration potential mapping.
Main types of forest degradation	The study is undergoing by National REDD+ Secretariat of Ethiopia (for recent data).
Driving forces	But according to draft report, the causes are complex and interconnected but two main drivers of deforestation and forest degradation have been emerging. The most prominent driver is conversion of forests to agricultural land. The second most prominent driver, with most of its impact focused on forest degradation, is unsustainable fuel wood consumption.
Current locations of forest degradation	The study is undergoing by National REDD+ Secretariat of Ethiopia (for recent data).
Location	The study is undergoing by National REDD+ Secretariat of Ethiopia (for recent data).
Source (logging / firewood etc,)	The study is undergoing by National REDD+ Secretariat of Ethiopia (for recent data).
Requirements for improving capacity Software, images, methodology.	**Software**: ERDAS, ArcGIS, ENVI, QGIS and R **Image :** RapidEye, SPOT **Methodology:** Standard Land use land cover manual according to Ethiopia context. How to change "From land cover to Land use"? because most of time
Recommendations for the workshop	We expect we can get additional knowledge and skill from the workshop. It will be supported with practical session. We will also expect get know how about the software, which will be used for the work shop can be integrated with the other tools like Openforis: Collect earth, Collect, Calc and Geospatial tool kit(FAO Software).

4.3.3. Forest change statistics

Ethiopia

Area in Square Kilometres

1990/2000

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 1990*
Tree Cover	34,696	725	64	118	-	35,603
Tree Cover Mosaic	746	86,827	1,505	1,053	32	90,164
Shrub Cover	85	1,351	543,618	3,386	12	548,453
Other Land Cover	257	290	2,206	421,427	30	424,210
Water	-	-	-	50	5,820	5,870
Total 2000	35,783	89,194	547,394	426,035	5,895	1,104,300

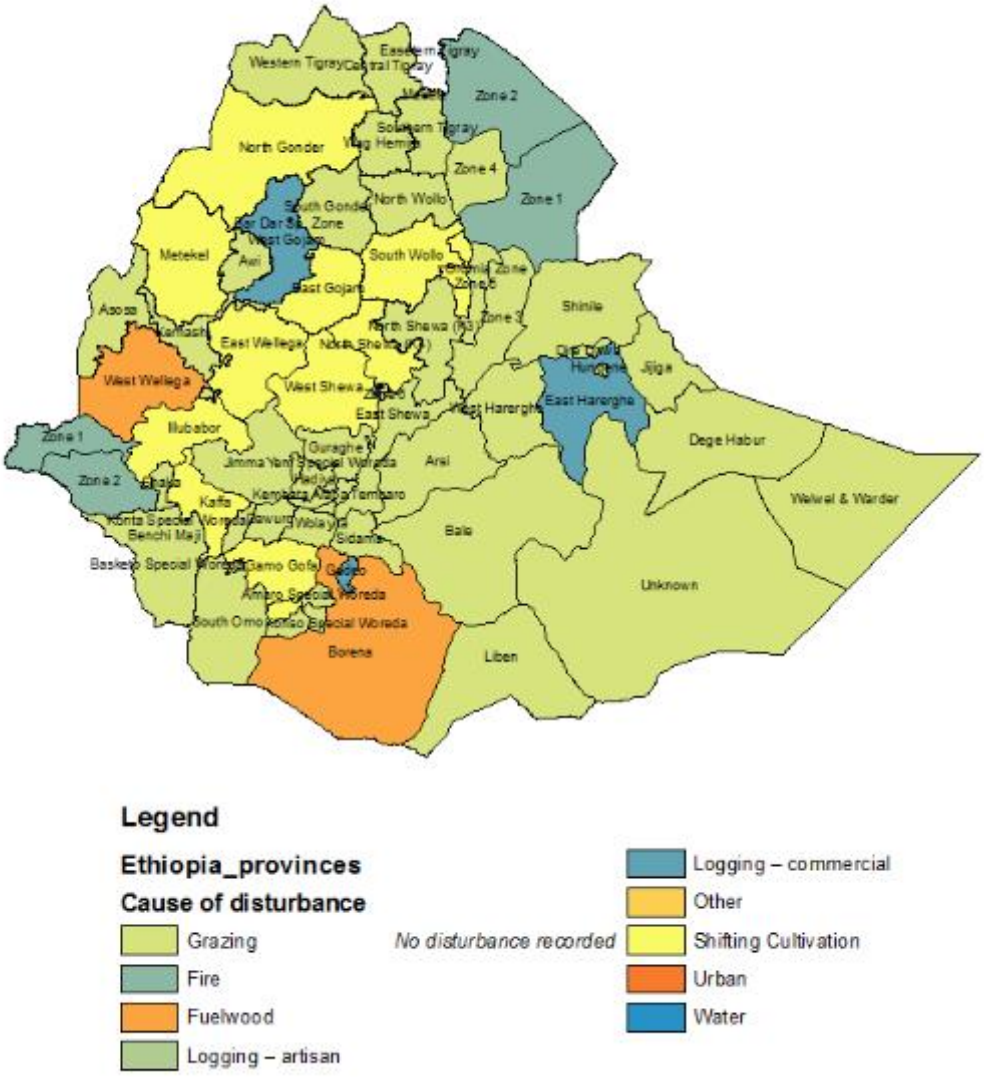
2000/2010

	Tree Cover	Tree Cover Mosaic	Shrub Cover	Other Land Cover	Water	Total 2000
Tree Cover	34,956	373	293	161	-	35,783
Tree Cover Mosaic	298	86,603	1,647	646	-	89,194
Shrub Cover	-	656	541,693	5,044	-	547,394
Other Land Cover	9	139	204	425,677	6	426,035
Water	-	-	13	27	5,854	5,895
Total 2010	35,263	87,771	543,850	431,555	5,860	1,104,300

2010/2015

	Tree Cover	Tree Cover Mosaic	Shrub Cover	Other Land Cover	Water	Total 2010
Tree Cover	35,097	27	139	-	-	35,263
Tree Cover Mosaic	-	86,930	779	62	-	87,771
Shrub Cover	-	-	543,532	318	-	543,850
Other Land Cover	74	-	31	431,450	-	431,555
Water	-	-	-	-	5,860	5,860
Total 2015	35,171	86,957	544,481	431,829	5,860	1,104,299

4.3.4. GIS of disturbances

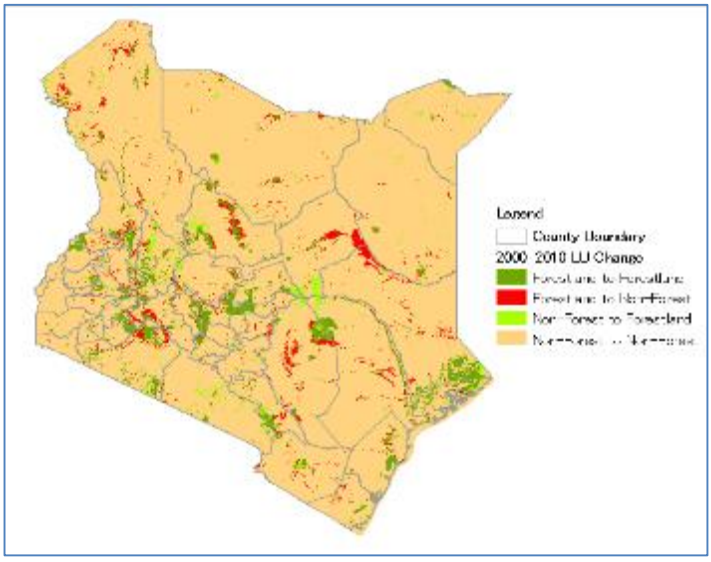


4.4. Kenya - Serah Kahuri

Kenya Forest Service

4.4.1. Overview

- **Forest definition:** This includes all land with woody vegetation consistent with thresholds used to define Forest Land in the national greenhouse gas inventory. These area as follows: - Minimum Tree Crown Cover = 15 % - Minimum Land Area = 0.5 ha - Minimum Tree Height = 2 m. It also includes systems with a vegetation structure that currently fall below, but in situ could potentially reach the proposed national values used to define the Forest Land category.
- **Deforestation**. The deforestation rate is around 12,000 ha annually.



- **The forest cover changes**: The land cover transition matrix for the years 1990-2010 show that forest was lost to mainly croplands and grassland, approximately in the proportion of one third and two thirds.

		2010						
		Forestland	**Cropland**	**Grassland**	**Settlements**	**Otherlands**	**Wetlands**	**Total LU Area in 1990 (Ha)**
1990	Forestland	2,917,841.7	543,984.1	1,118,997.6	928.9	19,247.8	69,877.3	**4,670,877.3**
	Cropland	218,024.7	8,692,727.2	285,950.5	43,818.1	1,539.0	16,060.3	**9,258,119.8**
	Grassland	971,034.8	810,541.3	40,095,452.0	32,351.9	702,252.1	116,556.0	**42,728,188.1**
	Settlements	147.9	7,283.8	1,359.7	48,175.6	3.6	82.4	**57,052.9**
	Otherlands	3,453.4	355.6	683,027.6	545.9	315,706.2	1,208.8	**1,004,297.5**
	Wetlands	25,944.1	16,870.3	141,763.2	57.2	5,989.5	1,281,144.6	**1,471,769.0**
	Total LU Area in 2010 (Ha)	**4,136,446.5**	**10,071,762.4**	**42,326,550.6**	**125,877.5**	**1,044,738.3**	**1,484,929.4**	**59,190,304.6**

Confusion matrix for land cover change between 1990 and 2010.

- **The institutions** involved in forest monitoring and management: Kenya Forest Service is the solely mandated agency, however it works closely with stakeholders. (e.g. DRSRS, RCMRD, NMK, KEFRI, KEMFRI)

- **Deforestation and degradation actors and drivers**: Agricultural expansion dominates the early and transition phases. Fuel wood and fires become more dominant in late post transition phases. Subsistence agriculture – fairly stable over all phases. Urban expansion – largest in the post-transition phase A series of drivers, direct and indirect can also be identified.

DRIVER CATEGORY	DIRECT DRIVERS	INDIRECT DRIVERS
Governance drivers	De-gazetting forest lands	*Poor governance, including weak institutions, corruption, illegal logging, weak law enforcement *Weak community participation
Policy drivers	Grazing Banning Taungya system Administration ofTaungya system	*Agricultural policies *Non-hollist focus on all forests
Other drivers		Inadequate of integration
Economic drivers	Poverty Conversion of trustland woodland to agricultural use Population pressures	High prices for agricultural products. Subsidies/Incentives- tax exemption for fertilizers, for farming tractors Fixing timber prices at too low levels

- **Technical needs for monitoring deforestation and degradation:** Human capacity building at higher levels MSc & PhDs in GIS and remote sensing applications in forestry. High resolution imagery at close temporal intervals to allow those areas with <15% CC to be monitored.

Capacity	Remote Sensing	GIS	Inventory
Basic information	*Medium*	*Good*	*Good*
Technical capacities	*Medium*	*Medium*	*Medium*
Human resources for field inventory – skills and material	*Below Medium*	*Below Medium*	*Below Medium*
Human resources for analysing data	*Medium*	*Medium*	*Medium*
Software and computer resources	*Good*	*Good*	*Medium*

4.4.2. Country Fact Sheet

Country Fact Sheet	**Kenya**
Institution	KENYA FOREST SERVICE
Other institutions involved in forest monitoring	KEFRI, DRSRS,UNEP,KEMFRI, CCI, RCMRD, SoK
Specify type (Government / Research etc).	GOVERNMENT
Mandate of your institution	National government body responsible for Forest Management
Institutional strengths	Human Resource &Technical capacity in GIS, RS & Geo-data base
Institutional weaknesses	Weak Forest monitoring and assessment policies
Specify (legal, technical , financial)	• Policy and legislations currently being realigned to conform to constitutional requirements • Expensive license based software for forest resources assessment • Capacity on GIS Analysis • Limited budgets
Specific areas to be addressed	Mobile mapping technology for data collection & dissemination of forest monitoring data Lidar technology
Structural Capacity for:	
Field survey	Trained staff but Survey approaches require updating
Remote Sensing	Inadequate numbers of staff ,Currently using Landsat 8
GIS	Above average
Current RS data available	
Specify data source , coverage , dates	Landsat 8 current and Alos 2 of 2010
Forest inventory data and maps	
Dates; coverage – regional , national	National; Currently ongoing activity
How were they produced?	KFS & Stakeholders with support from partners – JICA, World Bank and Government of Finland
Review of forest information	

Forest types and distribution;	Currently ongoing to align to international reporting systems
Forest protection	ENCOM Community Forest Associations
Forest change (deforestation)	Caused by forest poaching fires caused by honey gatherers
Forest change (degradation)	Charcoal extraction
Main threats	Encroachment from communities neighbouring forests, pressure from agricultural land especially in areas not officially gazetted as forest in the semi arid and arid areas
Current REDD initiatives In the country	1. Social inclusion in REDD+ -workshop Report _Nairobi Dec 2012 2. Roadmap for Establishing REDD, RL and NFMS 3. Kenya's REDD+ Readiness Preparation Proposal (RPP) 4. Kenya Water Towers , Forests and Green Economy- ANational Dialogue 5. Kenya RPP Annex 6. Forest Governance, REDD+ and Sustainable Development in Kenya 7. Draft SESA Road Map -Sep 2013 8. Charcoal Value Chain Analysis 9. Analytical Study on Corruption Risk Assessment for REDD+ in Kenya 10. Analytical Study on Carbon Rights and Benefit Sharing for REDD_ in Kenya 11. Analysis of Demand and Supply of Wood Products in Kenya 12. Analysis of Drivers of Deforestation &forest Degradation in Kenya
Other initiatives	
Main types of forest degradation	Loss of canopy cover
Driving forces	Forest fires, illegal logging, plantations clearfell as well as silvicutural operations in Plantation forest areas
Current locations of forest degradation	
Location	Distributed in small pockets in the country
Source (logging / firewood etc,)	Charcoal

Requirements for improving capacity Software , images, methodology	Human capacity enhancement, high resolution imagery, current international protocols
Recommendations for the workshop	Set up holistic capacity building fund

4.4.3. Forest change statistics

Kenya

Area in Square Kilometres			**1990/2000**			
	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 1990*
Tree Cover	5,507	1,481	451	233	35	7,706
Tree Cover Mosaic	913	38,930	2,590	893	12	43,338
Shrub Cover	250	2,023	273,186	2,571	14	278,044
Other Land Cover	122	71	915	219,597	4	220,709
Water	-	-	41	90	19,323	19,454
Total 2000	6,792	42,505	277,184	223,384	19,386	569,251

			2000/2010			
	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2000*
Tree Cover	4,613	1,458	219	502	-	6,792
Tree Cover Mosaic	599	39,588	1,533	778	6	42,505
Shrub Cover	131	305	274,322	2,426	-	277,184
Other Land Cover	16	320	420	222,629	-	223,384
Water	-	-	95	117	19,174	19,386
Total 2010	5,360	41,671	276,589	226,452	19,180	569,251

			2010/2015			
	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2010*
Tree Cover	4,937	131	29	263	-	5,360
Tree Cover Mosaic	-	40,704	553	415	-	41,671
Shrub Cover	18	-	276,020	519	32	276,589
Other Land Cover	42	134	80	226,194	-	226,452
Water	-	-	7	-	19,174	19,180
Total 2015	4,997	40,969	276,688	227,392	19,206	569,252

4.4.4. GIS of disturbances

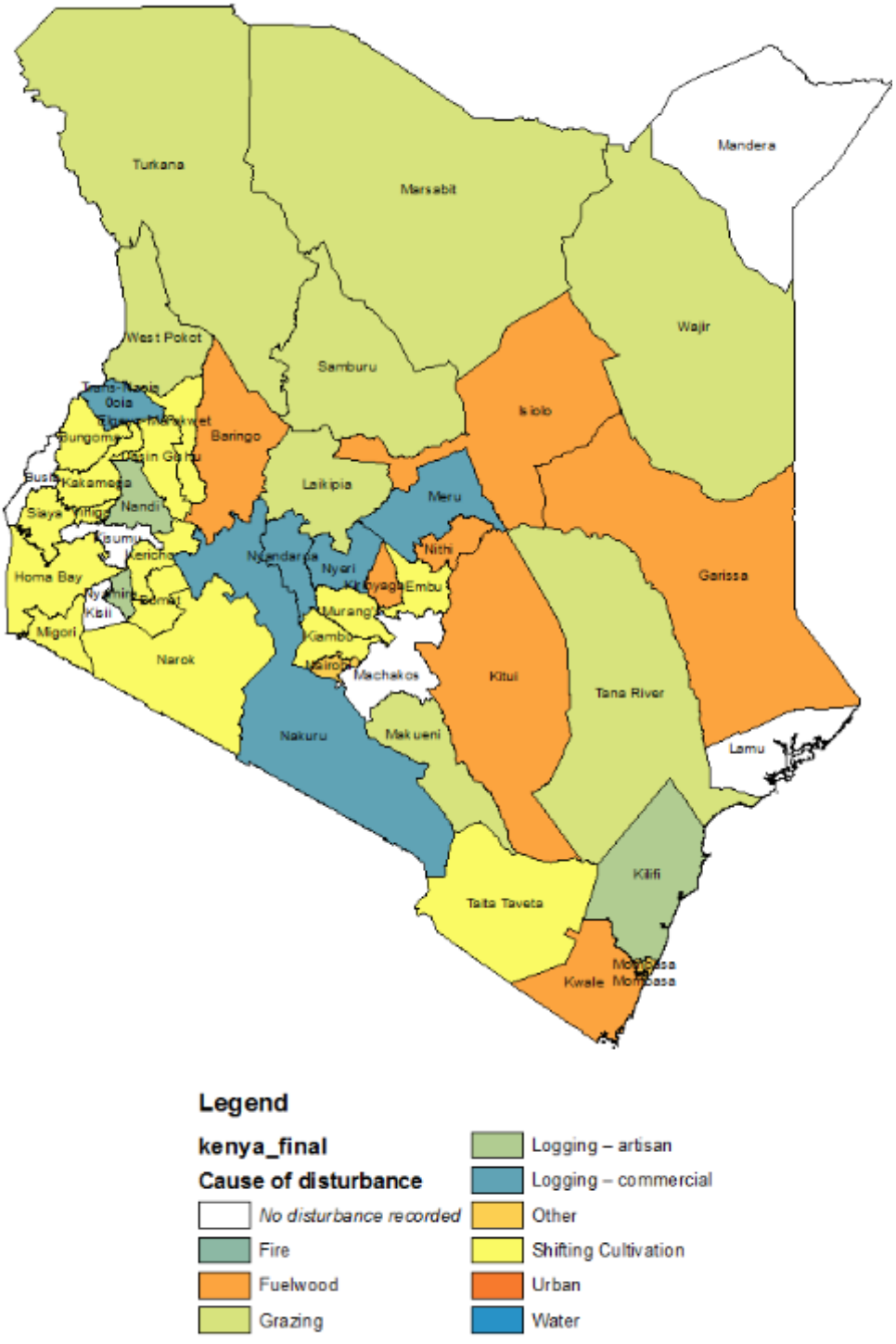


Figure 10: GIS for Kenya

4.5. Rwanda - Anastase Nyandwi

Rwanda Natural Resources Authority,

Department of Forestry and Nature Conservation

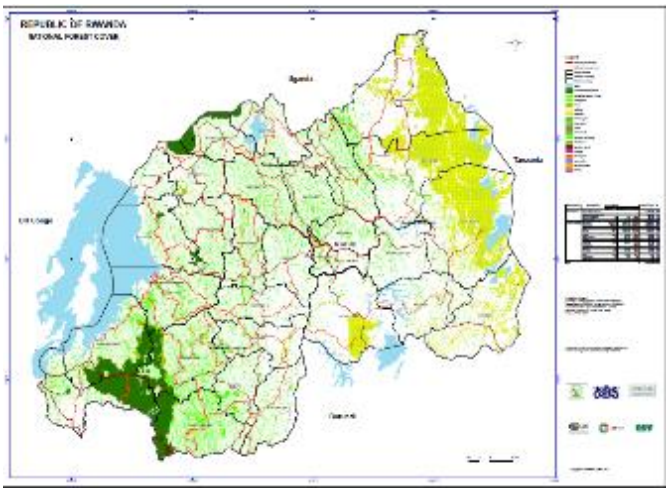
4.5.1. Overview

- **Forest definition:** A forest is an area of land that is at least 0.5ha in size, with a tree crown cover of at least 6% and tree with minimum height of 2m (RPP for Rwanda P104, 156P, October 2014). The definition includes planted and native forests as well as matures agroforestry systems.

- **Deforestation**. Available data show that forests in Rwanda, have been subjected to strong human pressure from agriculture activities. From 1930 up to 2012, natural forest areas declined by 65% according to Forest policy (Ministry of Forestry and Mines: MINIFOM, 2010).

- **The institutions** involved in forest monitoring and management: Ministry of Natural Resources (MINIRENA), Rwanda Natural Resources Authority (RNRA) in the Department of Forestry and Nature Conservation (DFNC)

- **Rwanda's lands** are intensively cultivated, however 26% remains either natural or plantation forests.



- **Forest protection** has been historically weak: For example: Nyungwe lost 14.8 % of it area from 1958 to 1978: Akagera National Park 72.2% has been destroyed between 1956 and 1994 period: Gishwati has lost 95.2% of its original area between 1930 and 2012.

- **Deforestation and degradation drivers**: Main actors farmers (agriculture and animal grazing); mining activities; infrastructure development; bushfires; population in resettlement schemes; population in agglomerations; bee keepers.

- **Technical needs and requirements to help monitor deforestation and degradation:** National and regional centres with suitable equipment. Long and short-term training in satellite forest monitoring. Software and hardware equipment to help in forest degradation and deforestation monitoring.

Capacity	Remote Sensing	GIS	Inventory
Basic information	Medium	Medium	Medium
Technical capacities	Medium	Medium	Medium
Human resources for field inventory – skills and material	Bad	Medium	Medium
Human resources for analysing data	Bad	Medium	Medium
Software and computer resources	Medium	Medium	Medium

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4.5.2. Country Fact Sheet

Country Fact Sheet	**Rwanda**
Institution	RNRA: Rwanda Natural Resources Authority in the Department of Forestry and Nature Conservation(DFNC) Under the Ministry of Natural Resources (MINIRENA)
Other institutions involved in forest monitoring	RAB: Rwanda Agriculture Board UR: University of Rwanda in the Department of Forestry and Nature Conservation REMA: Rwanda Environmental Management RDB: Rwanda Development Board in the Department of Tourism and Conservation Districts and Local authorities Kitabi College of Environment (KCE)
Specify type (Government / Research etc).	Government Institutions: RNRA, UR, REMA, RDB, RAB
	Research Institutions: UR, KCE, RAB
Mandate of your institution	1° implementing national policies, laws, strategies, regulations and government resolutions in matters relating to the promotion and protection of natural resources; 2° making a follow up and implementing international conventions Rwanda ratified on matters relating to the conservation of natural resources; 3° advising the Government on appropriate mechanisms for conservation of natural resources and investments opportunities; 4° registering land, issuing and keeping land authentic deeds and any other information relating to land of Rwanda; 5° ensuring proper geological data and their respective maps; 6° providing technical advice on the proper use of natural resources; 7° making follow up and supervising activities relating to proper management, promotion and valuation of natural resources; 8° rehabilitating and conserving where natural resources are damaged in the country; 9° making a follow up and supervising activities relating to the proper use of natural

	resources; 10° promoting activities relating to investment and added value in the activities of use and exploitation of natural resources in Rwanda; 11° initiating research and study on natural resources and to publish the results; 12° instituting regulations, guidelines and appropriate mechanisms for management, use and conservation of natural resources and ensuring their implementation; 13° establishing cooperation and collaboration with other regional and international institutions with an aim of harmonising the performance and relations on matters relating to management of natural resources.
Institutional strengths	Institution was established by Organic law All its activities related to National Land registration and Management, Mining and Geology, Forestry and Nature Conservation, Integrated Resources Management, are clarified by law.
Institutional weaknesses	Insufficiency in finance and Staff
Specify (legal, technical , financial)	
Specific areas to be addressed	
Structural Capacity for:	
Field survey	National Institute of Statistic of Rwanda(NISR) and Decentralised entities (District, Sectors, Cells and Villages)
Remote Sensing	-CGIS Centre for Research and Training in Remote sensing and Geographic Information System (CGIS) for the University of Rwanda (UR), -Department of Lands and Mapping(LMD) and Department of Forestry and Nature Conservation (DFNC) of Rwanda Natural Resources Authority
GIS	CGIS, LMD, DFNC, RDB, NISR,
Current RS data available	Aerial photographs, Satellites images
Specify data source , coverage , dates	1.Aerial photographs 2008-2009, with high resolution of 25cm,covering a part of the country, by Swedish Survey 2. Quick Bird Image 2008, High resolution to 25cm, Covering Bugarama and Volcano National Park

	3.LandSat 2005, 30resolution, entire covering, USA 4. Spot 2005, 10to 20mresolution, entire coverage/France 5. Aster 2005, 15m resolution, entire coverage, USA
Forest inventory data and maps	National Forest Inventory(NFI) 2007
Dates; coverage – regional , national	National Forest Cover Maps (NFCM)2007
How were they produced?	NFI and was carried out by the International Institute for Geo_Information Science and Earth Observation (ITC), Netherland in collaboration with Centre for Research and Training in Geographic Information System (CGIS) for the University of Rwanda (UR),Rwanda Agriculture Board(RAB). NFI and NFM were Financed by the Netherland Embassy in Rwanda
Review of forest information	
Forest types and distribution;	1. Humid Natural forest :33% 2. Eucalyptus Forest Plantations 26% 3. Young or Open Forest plantation or Coppices :16% 4. Degraded Natural Forests : 16% 5. Pine Forest Plantation : 5% 6. Bamboo Forest : 2% 7. Savana : 2%
Forest protection	4 National Parks and reserves(127015.7ha) 1. Akagera national park:1276.5ha 2. Volcano National park : 16218.8ha 3. Nyungwe National park :103863.1ha 4. Gishwati Mukura : 1800ha Created Recently
Forest change (deforestation)	54.29% between 1960 to 2007
Forest change (degradation)	10.23% between 1960 to 2007
Main threats	-Agriculture, Infrastructure, Industrial mining, Grouped Settlement and urbanization, Resettlement of returnees and old refugees, High population growth, Poverty
Current REDD initiatives In the country	Rwanda has publish its RPP(Readiness Preparation proposal) REDD+ Unit in the Department of Forestry and Nature Conservation (DFNC) in Rwanda Natural Resources Authority(RNRA) Gishwati Mukura Ntional Park Created in 2015
Other initiatives	The 2015th National Forest Inventory has started and it is ongoing. Permanent Evaluation and Information System(SIEP: Systèm d'Information et

	d'Evaluation Permanent in French) under the DFNC to help in Forest Monitoring
Main types of forest degradation	- Excessive and over harvesting degradation - Bush fire based degradation - Diseases and pests degradation - Invasive species based degradation
Driving forces	Direct and Indirect drivers of Forest Degradation Illegal tree cutting, wood energy, forest fires, soil erosion, grazing in forest, pests and diseases , mismanagement of forest plantations, limited forest extension services
Current locations of forest degradation	Pests: Insects biting Eucalyptus especially in dry season
Location	Eastern and southern Province
Source (logging / firewood etc,)	
Requirements for improving capacity Software , images, methodology	Long and short term courses Finances Equipments
Recommendations for the workshop	Respect of Agenda
	Provide Certificate to the participants at the end of workshop
	Providing an MU to Rwanda Natural Resources Authority

4.5.3. GIS of disturbances

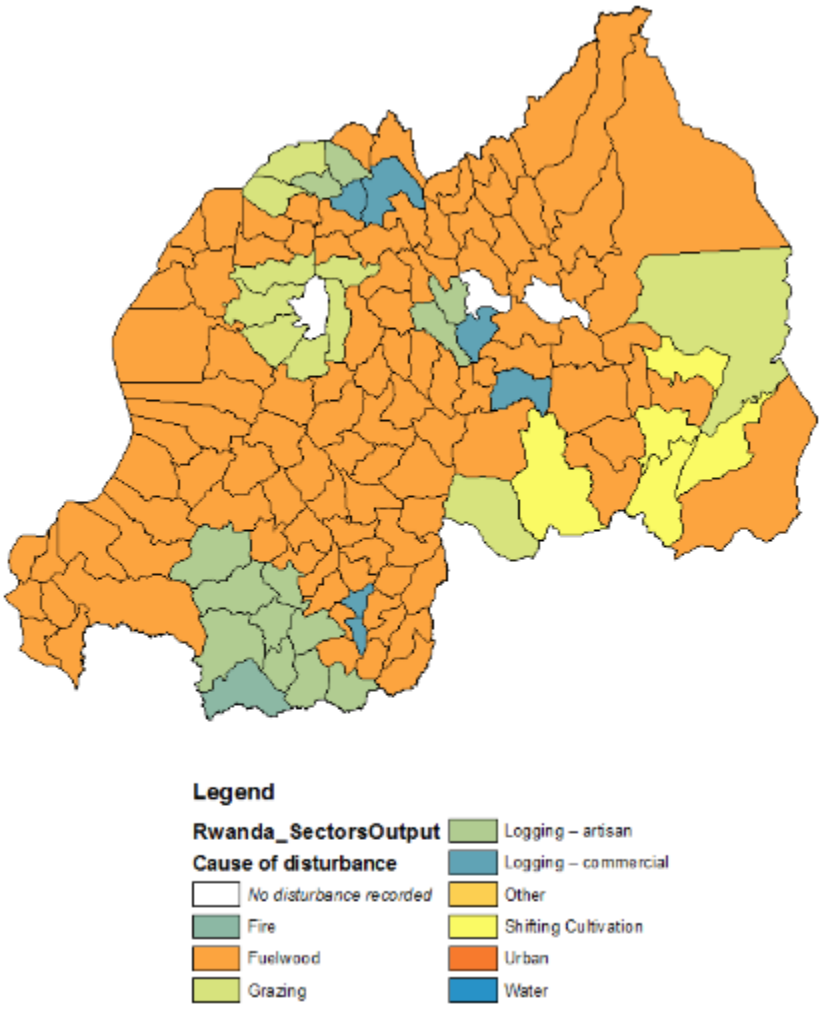

Figure 11: GIS for Rwanda

4.6. Somalia - Ibrahim Abdi-nur Yakub

Ministry Livestock Forestry & Range

4.6.1. Overview

Background and Climate

Somalia has a land area of 637,657 km² and situated in the Horn of Africa, with 12.5-16 million inhabitants. It is situated between latitude 12N and 1.35'S and longitude from 39E to 51E.The terrain is generally flat and low lying apart from the escarpment (Glolis Mountains) running parallel with northern coastal line where the highest reaches 2,400 meters.

The movement of inter tropical zone jointly associated intertropical front are the major influence of the climate in Somalia. This results in four seasons; two main rainfalls over the most of the country. The *Gu* (April to Jun) as the zone passes northwards and the *Dair* (October & November) in both seasons the rain is produced by air from Indian ocean. Thre are two dry seasons (Jilaal &Hagaa). The Jilaal period (December to March) which is the harshest season for the pastoralists' and their herds. Most of the country receives less than 500mm of rainfall annually and a large area in the northeast and much of northern Somalia receives as little as 50 to 150 mm, while south west receives 330 to 500mm of rainfall.

Daily maximum temperature vary from 30°C to 40°C. Northern Somalia experiences the greatest temperature extremes. Temperatures in the South are less extreme, ranging from about 20°C to 14°C. The hottest months are February to April and the coast is usually 5 to10°C cooler than the hinterland. The coastal zone remains about at 70% humidity even during the dry season.

Vegetation and Deforestation

The vegetation in Somalia is predominately dry deciduous bush land and thicket dominated by species of Acacia and Commiphora, with semi desert grassland and deciduous shrub land in the north and along much of the coast. The vegetation becomes denser towards the south, though many of the plains of the north eastern part of the country are devoid of trees. There is annual deforestation rate of 0.97% of all type of forest and wood land, over 60% of the country is covered by sparse savannah woodland.

Somalia lost an average of 76,750 ha per year or 0.93% of its forest per year in the total 1990-2010 (FAO) and also lost 18.5% of its forest cover, or around 1,535,000 ha. The rapid deforestation is due famine, war illegal and ruthless logging and agricultural practice which is still under the early stage of human lifestyle. Fuel wood (fire wood & charcoal) not only for cooking, but for all life earning and utilization. The forest ownership in Somalia is public.

In General, about 40-50% of the land cover is considered permanent pasture and used as rangelands. Around 13% of the country is suitable for cultivation and less 4% is forest cover. This pattern however is constantly changing due to land degradation.

The plight of forestry is one of the serious concerns of the forestry department, which has neither funds nor staff to conserve or manage the forests with efficiency in accordance with sound environmental and economic principals. The weakness of forestry department and the technical difficulty of growing trees in Somali (relatively low rainfall and poor soil) have been an important factors in a serious decline in donor support for forestry section.

Capacities

Somalia experienced a mass exodus of high skilled staff and experienced professionals during the civil war period and the gap has not been filled. Therefore there is a need for support to strength existing staff through training so that young professionals may acquire at least certificates, diploma and degree qualifications.

There are few local and international institutions operating in the country. Caritas Somalia has been supporting local NGOs providing advice on sustainable utilization of forest resource including transfer of knowledge and experts in Hargeisa. The World Food Program has supported establishment of tree nurseries in Hargeisa town and other places. FAO are supporting the National tree planting day celebrations funds on 17 April annually. In the south, UNDP prepared a project related on alternative charcoal production. FAO is under preparing a biodiversity strategy and Action plan with the directorate of environment under Prime Minister's Office.

Causes of degradation
Steep topography
Strong Wind
Dry land farming
Sheet and galley erosion
Over grazing Collection of fuel wood and construction materials
Sever forest exploitation for the purpose of charcoal.
Reduction of vegetation cover an
Decline in soil fertility
Sand dune encroachments
Soil erosion, sand dune hazardous, toxic dumping and wild life poaching and
Natural disaster such as drought and dust storms over the northern and eastern plan

Current efforts to monitor natural resources

To design a frame work for assessing and monitoring land degradation in Somalia based in pilot studies in different parts of the country,

National assessment using available low resolution data as a baseline for identifying local hotspots for comprehensive assessments.

Semi detailed local assessment in the pilot areas of the country,

Capacity building (Technical staff) and institutional support to sustain future assessment and monitoring activities for land degradation. The main barriers to improve forest degradation monitoring are the lack of skilled staff and computer expertise, hard ware and software and financial resources.

The most important environmental disaster effecting Somalian forest includes, deforestation, desertification, degradation, soil erosion, sand dunes, hazardous toxic dumping and wildlife poaching. Natural pressures, such as drought, frequent dust storms over the northern and eastern plane are also a major problem.

The absence of effective central government institutions to deal with environmental issues is crucial.

The country suffers all type of environmental degradation, both natural and man-made on the one hand - while on the hand is lacking both human and financial resource as well as political stability to address this life affecting issue.

4.6.2. Forest change statistics

Somalia

Area in Square Kilometres			**1990/2000**			
	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 1990*
Tree Cover	3,492	24	-	-	-	3,516
Tree Cover Mosaic	-	42,052	154	443	-	42,649
Shrub Cover	-	269	387,674	3,524	-	391,468
Other Land Cover	-	37	1,590	198,397	-	200,024
Water	-	-	-	-	-	-
Total 2000	3,492	42,382	389,419	202,363	-	637,657

			2000/2010			
	Tree Cover	Tree Cover Mosaic	Shrub Cover	Other Land Cover	Water	Total 2000
Tree Cover	3,492.25	-	-	-	-	3,492
Tree Cover Mosaic	-	41,241	668	473	-	42,382
Shrub Cover	-	0	388,064	1,355	-	389,419
Other Land Cover	-	-	764	201,599	-	202,363
Water	-	-	-	-	-	-
Total 2010	3,492	41,242	389,496	203,427	-	637,657

			2010/2015			
	Tree Cover	Tree Cover Mosaic	Shrub Cover	Other Land Cover	Water	Total 2010
Tree Cover	3,482	11	-	-	-	3,492
Tree Cover Mosaic	-	41,059	51	132	-	41,242
Shrub Cover	-	-	389,217	279	-	389,496
Other Land Cover	-	12	508	202,907	-	203,427
Water	-	-	-	-	-	-
Total 2015	3,482	41,081	389,776	203,318	-	637,657

4.6.3. GIS of disturbances

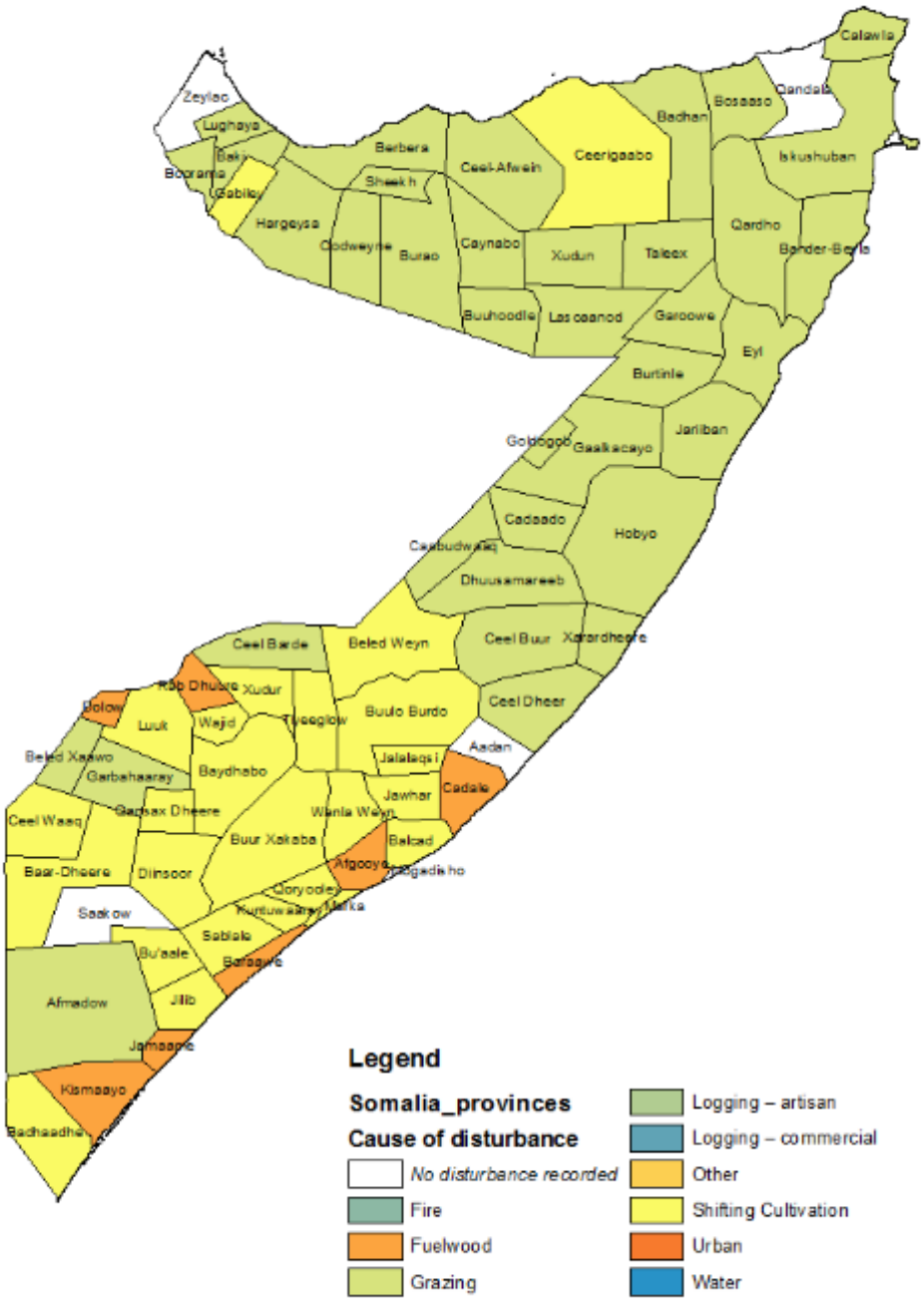

Figure 12: GIS for Somalia

4.7. South Sudan - Simon Dralley & Bronica Akol

Ministry of Agriculture, Forestry, Cooperative and Rural Development

4.7.1. Overview

- **Forest definition:** Land spanning more than 0.5 ha with trees higher that 5 m and canopy cover of more than 10 %, or trees able to reach these threshold in situ. It does not include land that is predominantly under agriculture or urban landuse.
- **Deforestation**. No current data
- **The institutions** involved in forest monitoring and management: Ministry of Agriculture, Forestry, Cooperative and Rural Development, Ministry of Environment, National Bureau of Statistics , Water Resources and Irrigation, Wildlife Conservation and Tourism, FAO, UNDP
- **Deforestation and degradation actors**: Main actors: Government (establishment of agricultural schemes, urban areas), farmers, exploration oil companies, cattle keepers, hunters, illegal commercial companies.
- **Deforestation drivers**: Charcoal/bricks burning and fuel wood production, shifting cultivation, over grazing, fire, settlement and urbanization, illegal timber harvesting for construction.
- **Technical needs and requirements to help monitor deforestation and degradation:** Establishment of a monitoring system. Continuous capacity building programme for the staff (Advanced GIS and Remote Sensing). Software, Hardware, Internet connection, adequate funding. Collaboration with national, regional, and international bodies working in monitoring of deforestation.

Capacity	Remote Sensing	GIS	Inventory
Basic information	Medium	Medium	Medium
Technical capacities	Medium	Medium	Medium
Human resources for field inventory – skills and material	Medium	Medium	Medium
Human resources for analysing data	Bad	Medium	Medium
Software and computer resources	Bad	Bad	Bad

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4.7.2. Country Fact Sheet

Country Fact Sheet	**South Sudan**
Institution	Ministry of Agriculture, Forestry, Cooperative and Rural Development.
Other institutions involved in forest monitoring	Ministries of Environment; Water Resources and Irrigation; Wildlife Conservation and Tourism; Livestock Development and Fisheries Industries
Specify type (Government / Research etc).	Government Institution
Mandate of your institution	Forest Policy 2015 aims at ensuring a sufficient and sustained forest resource base and flow of forest goods and services to support the livelihoods and socio- economic development without compromising this endowment for future generations
Institutional strengths	Existence of a forest policy document; drafted forest bill(Act); substantial number of forest technocrats; cooperate/collaborate with regional and international environmental Organizations; technocrats trained and capacity built
Institutional weaknesses	Financial limitations (annual budget); ; legal frameworks incomplete; and shortages in trained technical manpower
Specify (legal, technical , financial)	
Specific areas to be addressed	Technical and Financial support extremely required for training & capacity enhancement
Structural Capacity for:	
Field survey	Medium
Remote Sensing	Medium
GIS	Medium
Current RS data available	Forest Resource Assessment (FRA/FAO)
Specify data source , coverage , dates	Remote sensing images, all the country, 2013
Forest inventory data and maps	Limited Plantations Surveys & Inventories NFG/LRSIC
Dates; coverage – regional , national	2008-2011, Forest Plantations (limited), National Forest Inventory not tackled
How were they produced?	Plantations Satellite images and ground trothing of specific plantations
Review of forest information	NA
Forest types and distribution;	NA

Forest protection	Limited
Forest change (deforestation)	NA estimated as high
Forest change (degradation)	NA estimated as high
Main threats	Illegal logging in natural / woodlands logging for charcoal production; wood fuel, timbers
Current REDD initiatives In the country	REDD+ Program not launched however, Institutional Capacity Needs Assessment (UNDP) carried out and Stakeholders workshop
Other initiatives	UNDP
Main types of forest degradation	
Driving forces	Forest Degradation types & driving forces: Charcoal burning; illegal logging; nomadic grazing; annual forest fires; and widespread shifting/semi mechanized field crop production; Petroleum Oil production
Current locations of forest degradation	
Location	Degradation widespread and relative to regions over the whole country
Source (logging / firewood etc,)	Logging/firewood and timber for construction; Charcoal burning; illegal logging; nomadic grazing; annual forest fires; and widespread shifting/semi mechanized field crop production; Petroleum Oil production
Requirements for improving capacity Software , images, methodology	*Training personnel, equipment procurement (purchase of computers &software) availability of images, and training of personnel in data analysis methodologies such as fire observation & Forest Change detection*

4.7.3. Forest Change Statistics

South Sudan

Area in Square Kilometres

1990/2000

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 1990*
Tree Cover	4,898	380	114	-	-	5,392
Tree Cover Mosaic	491	33,848	953	336	-	35,628
Shrub Cover	46	668	379,006	6,967	257	386,943
Other Land Cover	-	145	6,946	181,560	140	188,791
Water	-	-	64	14	2,912	2,990
Total 2000	5,436	35,040	387,083	188,877	3,309	619,745

2000/2010

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2000*
Tree Cover	4,522	748	165	-	-	5,436
Tree Cover Mosaic	54	31,613	1,959	1,414	-	35,040
Shrub Cover	132	1,566	378,803	6,496	85	387,083
Other Land Cover	-	43	5,370	183,429	34	188,877
Water	-	-	13	109	3,187	3,309
Total 2010	4,709	33,971	386,311	191,448	3,306	619,745

2010/2015

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2010*
Tree Cover	4,664	20	25	-	-	4,709
Tree Cover Mosaic	-	32,915	867	189	-	33,971
Shrub Cover	-	275	382,439	3,597	-	386,311
Other Land Cover	-	208	2,865	188,350	26	191,448
Water	-	-	147	178	2,980	3,306
Total 2015	4,664	33,417	386,343	192,313	3,006	619,745

4.7.4. GIS of disturbances

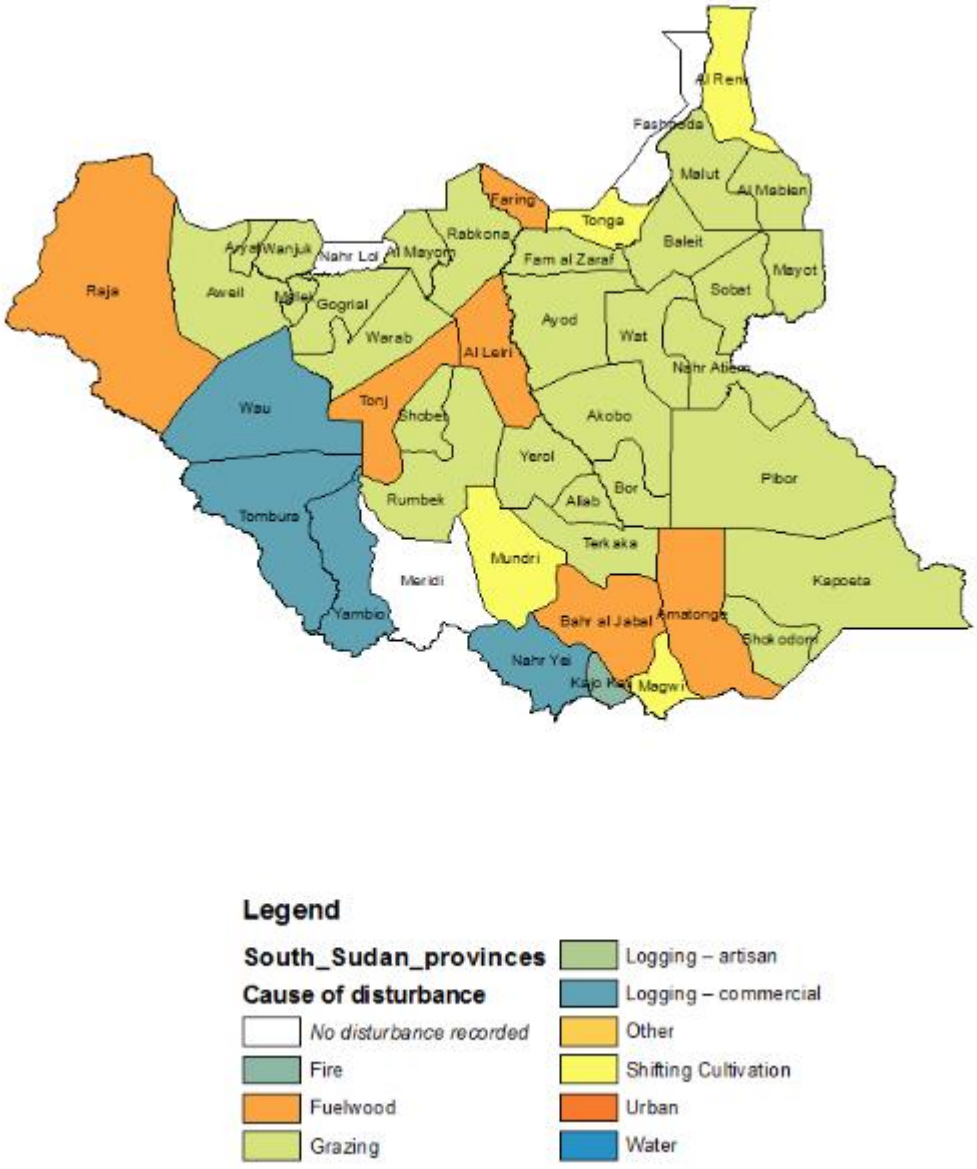


Figure 13: GIS for South Sudan

4.8. Sudan - Hanady Ibrahim Abdelgabbar & Safaa Ahmed Beraima

Forest National Corporation

4.8.1. Overview

- **Forest definition:** Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.
- **Deforestation:** The deforestation rate in Sudan at 174 415 ha/year, with a total forest area 2015 of 19,209,938 ha – and an annual deforestation rate of 0.9% .
- **The institutions** involved in forest monitoring and management: Climatology Department. HCENR (Higher Council of Environment &National Resources), FRC (Forest Research Centres), Ministries of Environment, Agriculture, Wild life, Range lands. Universities. RSA. (Remote Sensing Authority).
- **Forest Protection** in the country is robust, in that we have a strong legislation, forest policy and law. However the deforestation rate is high (0.9%) due to the drivers of increased population annual growth rate, need for energy, agricultural expansion and all the other drivers of deforestation and forest degradation.The policy and law standing alone, will not reduce the deforestation and forest degradation
- **Deforestation drivers**: Energy Consumption, Horizontal agricultural expansion, Overgrazing, Wildfire, Illegal cutting, Natural disaster (drought, floods, diseases…), war and conflicts, National development projects (petroleum, dams, electricity, mining etc…..

Direct causes of deforestation and degradation

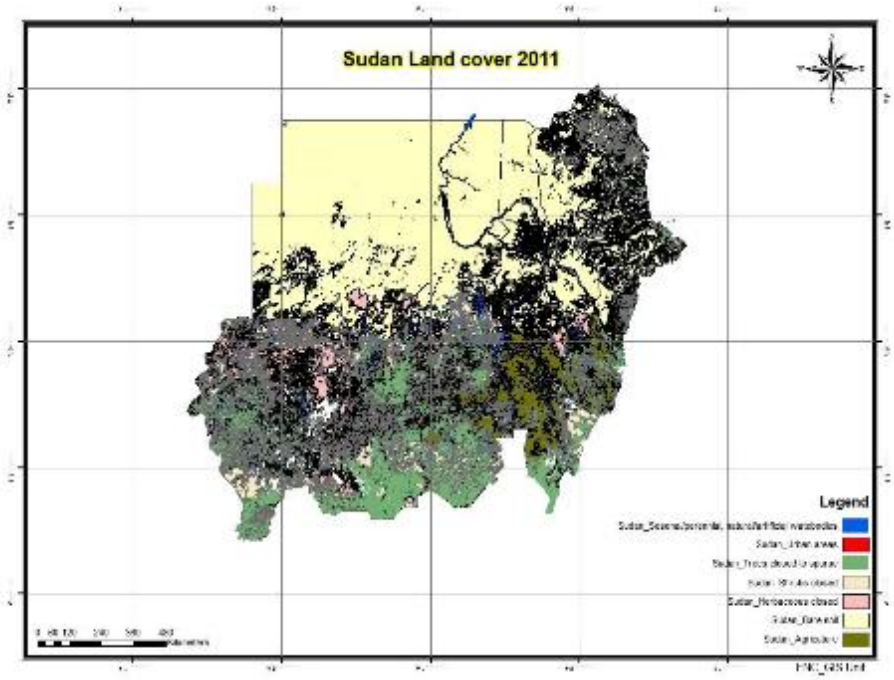
Sector	% of degradation	% of deforestation	Total deforestation by sector
Agriculture:	50%	80%	80%
-Mechanized	-	35%	
-Private schemes	-	08%	
-Traditional Agric.	50%	35%	
-Irrigated	-	02%	
Illegal traders on wood products consumers/beneficiaries	30%	15%	15%
Animal Wealth	10%	-	-
National development projects	02%	05%	05%
-Roads	-	02%	
-Electricity/dams	-	01%	
-Communications	-	01%	
-Energy & Mining	-	01%	
Visitors	08%	-	-
Expansion of population Centers	-	Less than 1%	Less than 1%

- **Technical needs and requirements to help monitor deforestation and degradation:**

  Review of forest inventory and methodologies in Sudan and links to GHGs inventory, Fund, software, capacity building, exchange experiences and training.

  Strengthen the remote sensing and GIS lab (RS/GIS) in the headquarters and the regions (Sectors) to monitor the forests including forest fires monitoring (Initiate steps for Sudan Forest Monitoring Systems SFMS). The forest fire is the most serious threat facing the forests in general and the natural forest resources in particular.

  Promotion of the department of Plant Protection - the effort to combat locusts *Anacredium melanorhodon melanorhodon*"Sari-elail", one of the most serious pests that threaten the production of Gum Arabic GA.



Capacity	Remote Sensing	GIS	Inventory
Basic information	Medium	Medium	Good
Technical capacities			
Human resources for field inventory – skills and material	Medium	Medium	(FNC) has qualified staff in Forest inventory &field survey
Human resources for analysing data	Medium	Medium	Good
Software and computer resources	Low	Low	Medium

4.8.2. Country Fact Sheet

Country Fact Sheet	**Sudan**	
Institution	Forests National Corporation	
Other institutions involved in forest monitoring	Climatology Department, HCENR, FRC, ministries of environment, agriculture, wild life, range lands, universities, RSA,	
Specify type (Government / Research etc).	Government & Research etc	
Mandate of your institution	Protection, conservation, afforestation, forest extension and forests management of the whole forests of Sudan	
Institutional strengths	A corporation, with a legislation, policy and law. A board of directors, Qualified& Professional staff etc. with infrastructure, covers 17 states.	
Institutional weaknesses	Capacity building, new technologies and financial issues	Strengthen of capacity building , Keep up with technological development, Providing the financial support
Specify (legal, technical , financial)	Lack of activation of laws and legislation, Changes in subordination between various ministries	Empowerment of laws and legislation, Stability of administrative status
Specific areas to be addressed	Drivers of deforestation, social and environmental issues, MRV (monitoring reporting and verification)	
Structural Capacity for:		
Field survey	good	Build based on related institutional arrangement, training in new issues(carbon

		calculation ,....)
Remote Sensing	Medium-low, or moderate to low	
GIS	Medium	
Current RS data available	FNC have legacy on RS data, but need to strengthened	Afri-cover 2000 and 2010
Specify data source , coverage , dates	Land Sat images, MODIS, SPOT. Dates 2000 and 2010, whole coverage in2000 and in 2010 N. Sudan separated (Atlas).Field, researches, studies and projects,	
Forest inventory data and maps	Inventory 1995-1998,2000.	
Dates; coverage – regional , national	Covered (16)states in N. Sudan except one state.	
How were they produced?	Handmade maps in the document 1998	need update
Review of forest information		
Forest types and distribution;	Dessert, low and high savannas', wet south-west the country, vegetation types	
Forest protection	System for fire protection and staff available,	New technologies, improvement of fire system
Forest change (deforestation)	The deforestation rate is high, in spite of the afforestation rate is more than 200,000 feddan annular but the deforestation rate is about 1.75 according to the last assessment after the separation	
Forest change (degradation)		Need studies and pilot survey
Main threats	Agriculture and energy consumption from the biomass	
Current REDD initiatives In the country	Sudan ongoing on implementation of Readiness supported by FCPF (Forest carbon partnership facility-	

	World Bank), -	
Other initiatives	- CDM not yet, green economy, - Carbon sequestration project (ongoing – GEF fund) Global Environmental Facility - Great green wall (ongoing)	
Main types of forest degradation	-1-Human induced 2- Natural 3- Biotic	
Driving forces	Agricultural expansion 2- Energy consumption 3- Increasing demand for grazing & browse material 4- Refugees and internally displaced people 5- Factors affecting forest health 6- Natural Disturbances.	
Current locations of forest degradation	In whole of the Country (Sudan):	
Location	Severe in North and central. Light in south. High in west.	
Source (logging / firewood etc,)	Agricultural expansion, human consumption.	
Requirements for improving capacity Software , images, methodology	Fund, software, capacity building, exchange experiences and training	
Recommendations for the workshop	• Sudan need more attention in the above issues mainly in capacity building and training • Strengthen the RS lab and states and at the level of Head Quarter. • Forests fire is the most serious threat facing the natural forests in general and the reserved forests in particular. • Establishment of a	

	unit for geographical information for monitoring and follow-up fires inside and outside the reserved forests. • Promotion of department of Plant Protection - the effort to combat locusts "Sari-elail", one of the most serious pests that threaten the production of Gum Arabic	

4.8.3. Forest Change Statistics

Sudan

Area in Square Kilometres

1990/2000

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 1990*
Tree Cover	306	-	-	-	-	306
Tree Cover Mosaic	71	2,481	119	-	-	2,671
Shrub Cover	72	132	193,812	4,983	-	198,999
Other Land Cover	97	216	1,652	1,678,472	195	1,680,634
Water	-	-	-	245	3,215	3,460
Total 2000	546	2,829	195,583	1,683,700	3,409	1,886,069

2000/2010

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2000*
Tree Cover	265	-	153	127	-	546
Tree Cover Mosaic	-	2,189	122	518	-	2,829
Shrub Cover	-	3	191,094	4,396	91	195,583
Other Land Cover	-	193	1,071	1,681,828	609	1,683,700.45
Water	-	-	-	268	3,140.88	3,409
Total 2010	265	2,386	192,440	1,687,137	3,840	1,886,068

2010/2015

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2010*
Tree Cover	- 72	-	24	314	-	265
Tree Cover Mosaic	-	1,541	201	632	12	2,386
Shrub Cover	-	-	185,398	6,952	90	192,440
Other Land Cover	17	429	13,968	1,672,434	290	1,687,137
Water	-	13	68	213	3,547	3,840
Total 2015	- 55	1,984	199,658	1,680,544	3,938	1,886,069

4.8.4. GIS of disturbances

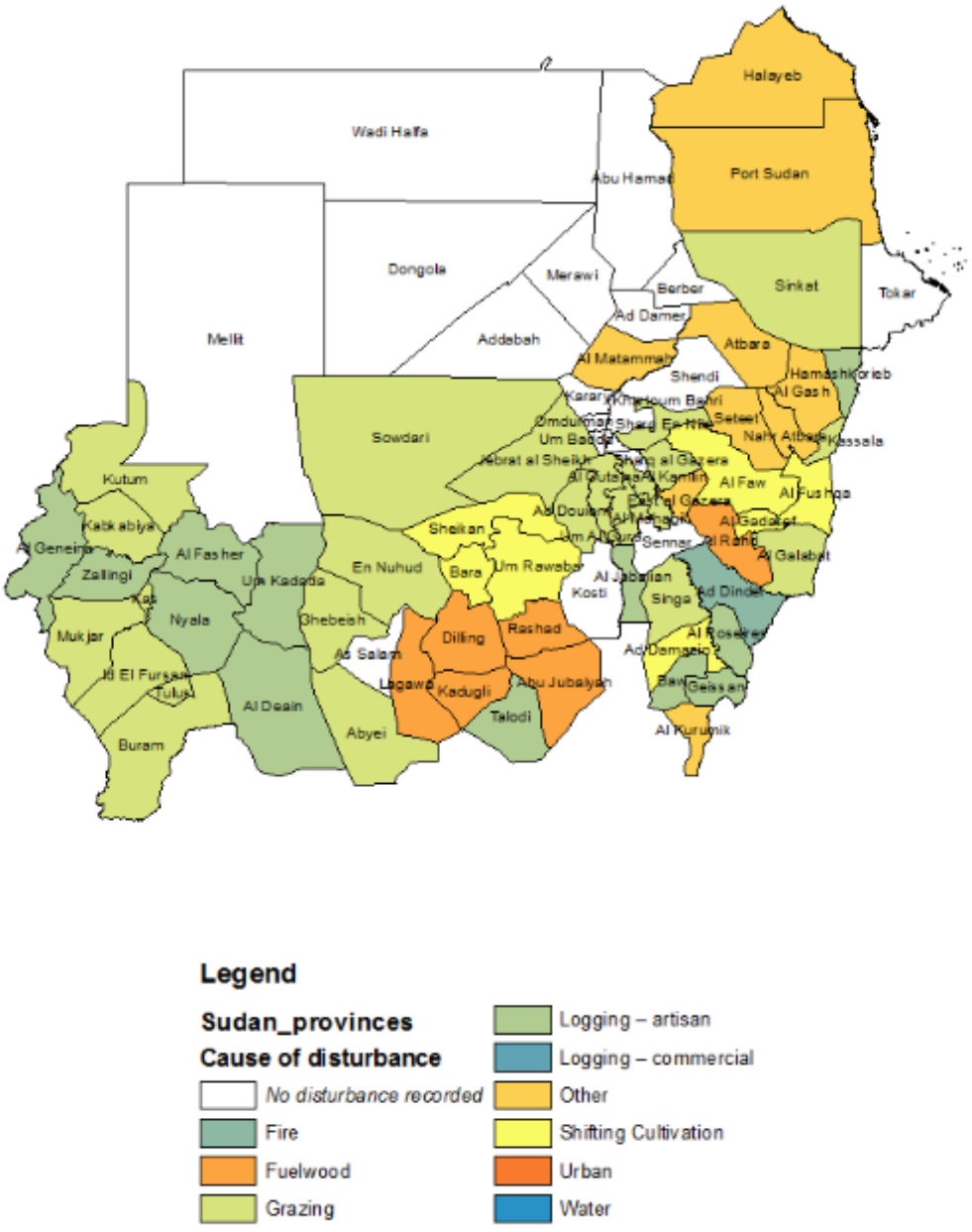


Figure 14: GIS for Sudan

4.9. Tanzania - Nurdin Chamuya & Jared Otieno

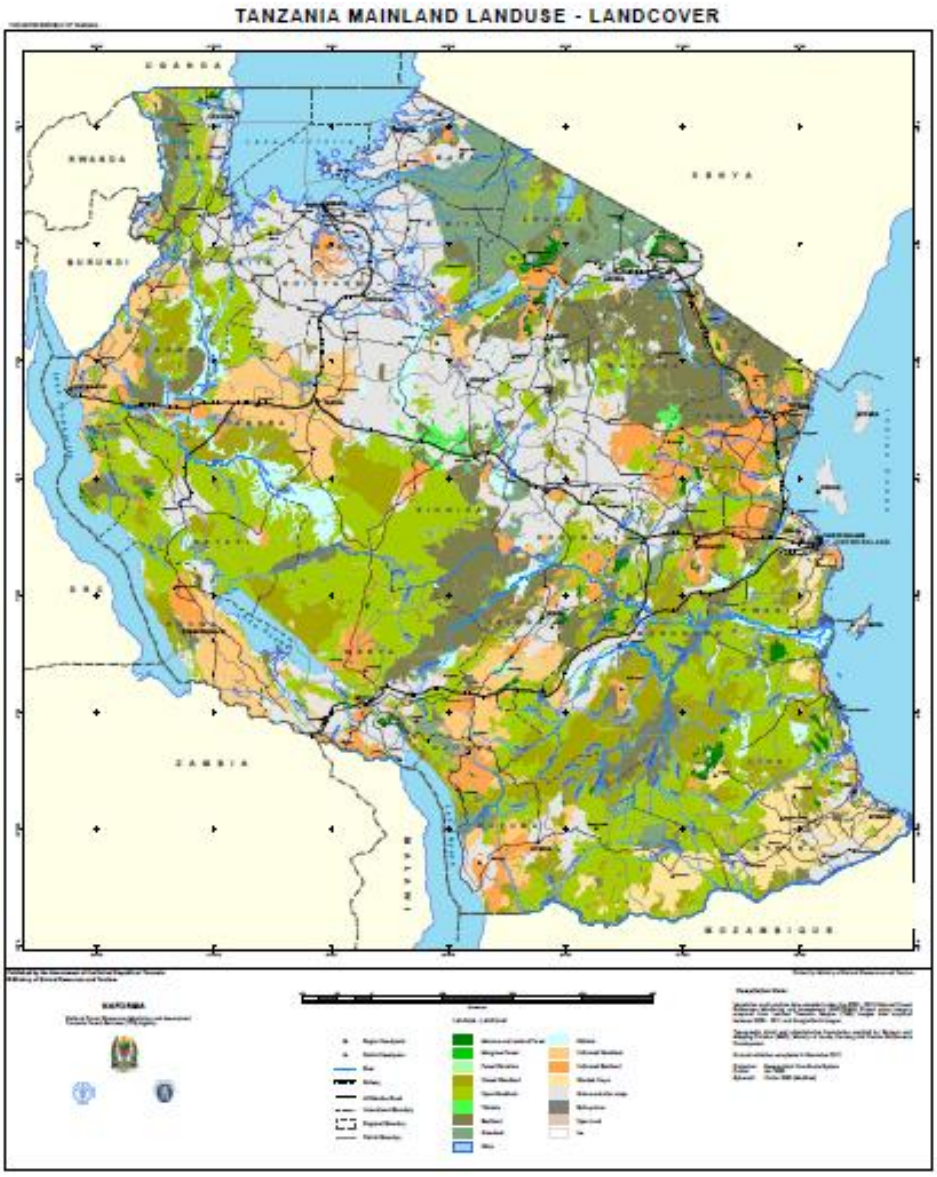
Tanzania Forest Service

4.9.1. Overview

- **Forest definition:** *Tanzania definition (CDM*): Forest has to meet the three thresholds of at least 0.5 hectares, minimum tree crown cover of 10%; a minimum height of 2.0 metres at maturity in situ. *The Forest Act*: At least 0.5-1 hectares, minimum tree crown cover of 10% - 30%, a minimum height of 2.0- 5 meters at maturity in situ.
- **Deforestation.** Different studies have provided quite different results, mainly due to problems in accurately monitoring changes in dry forests: Woodlands are the most degraded forest type and subjected to frequent wildfires and other humans activities like shifting cultivation.

- **The institutions** involved in forest monitoring and management: Ministry of Natural Resources and Tourism (Tanzania Forest Service), Vice-President Office-Department of Environment (VPO-DOE), Sokoine University of Agriculture (SUA) , Tanzania Forest Research Institute (TAFORI), Prime Ministers' Office- Regional Administration and Local Government (PMO-RALG).
- **The forest types and land cover:** The area covered by forest and woodlands in Tanzania mainland is 48.1 million hectares. They consist of humid montane, lowland, mangroves, plantation and woodlands which cover in total about 55% of the total land area. Around 25% of the country is under cultivation. Grasslands and bushlands occupy 7% each.
- **Forest ownership**: Central Government 37%, Local Authority 7.4%, Private 9.5%, village land 39.9%
- **Forest protection**: There is strong political commitment from the Tanzania Forest Service and Government to Sustainable forest management (SFM) as forests are seen as a valuable national asset (Available Forest and bee resources are estimated at 48.1 million hectares, corresponding to 3.3 billion. m^3 of Roundwood). Trained Staff on forest and bee resources management and suitable policies and legal framework are in place.
- **Deforestation and degradation drivers**: Increased illegal logging- often for charcoal production, farming practice, wild fires, overgrazing, settlements in the forest, and mining.
- **Technical needs and requirements to help monitor deforestation and degradation:** Forest resources data analysis tools and methodologies Access to high resolution satellite imageries and processing chains. Programs and software for monitoring different ecological systems, Accessibility to regional mapping hub for historical data, sharing technical capacities in the region regarding monitoring of forest deforestation and degradation.
- **Future prospective**: These forests are under severe pressure as they are the main source of energy of the expanding population leading to widespread degradation. Total national annual forest growth is estimated at 83.7 mil m3. However, only about 42.8 million m^3 is available for harvesting at a sustainable level. The annual

consumption of wood is estimated at 62.3 mill. m^3. The consumption exceeds the sustainable supply by 19.5 million m^3 annually



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4.9.2. Country Fact Sheet

Country Fact Sheet	**The United Republic of Tanzania**
Institution	Tanzania Forest Services (TFS) Agency
Other institutions involved in forest monitoring	• Vice Presidents Office (Division of Environment- Govt.), • Sokoine University of Agriculture (SUA- Research), • Tanzania Forest Research Institute (TAFORI- Research) • NGOs (TFCG, MPINGO, KVTC)
Specify type (Government / Research etc).	Government
Institutional duties	• Conservation and sustainable supply of quality forest and bee products and services • Development and management of forest and bee resources
Institutional strengths	Availability of forest resources, skilled staff and commitment.
Institutional weaknesses	Insufficient financial availability and technology
Specify (legal, technical, financial)	• Weak laws enforcement • Shortage of skilled personnel and technology • Insufficient financial capability
Specific areas to be addressed	Financial support and capacity building
Structural Capacity for:	
Field survey	Data analysis (models/equations)
Remote Sensing	HR imageries and Processing chain
GIS	Processing programme and software
Current RS data available	Shape files of Tanzania LULC of 2010
Specify data source , coverage , dates	Landsat images, some parts of the country, 2000-2010
Forest inventory data and maps	NAFORMA inventory data and LULC Maps
Dates; coverage – regional , national	2009-2014 national forest inventory
How were they produced?	LULC map- analysis of Landsat images;

	Forest data – fieldwork
Review of forest information	
Forest types and distribution;	Humid montane, lowland, mangroves, plantation, woodlands which covers about 55% of the total land area
Forest protection	Effective forest protection in place including the establishment of forest surveillance unit
Forest change (deforestation)	373,000 hectares
Forest change (degradation)	Not determined
Main threats	Fire, wood fuel, Agricultural expansion, over grazing, refugees, etc
Current REDD initiatives	National REDD framework and Strategy, REDD pilot projects results
Other initiatives	PPP, Tree growing companies and individuals
Main types of forest degradation	Unplanned selective logging
Driving forces	Fire, wood fuel, Agricultural expansion, over grazing etc
Current locations of forest degradation	
Location	Throughout all types of forests
Source (logging / firewood etc,)	Illegal logging for charcoal, timber and firewood
Requirements for improving capacity Software , images, methodology	RS, GIS, improved methodology and software
Recommendations for the workshop	Provision of the needs for forest resources assessment and monitoring

4.9.3. Forest Change Statistics

Tanzania

Area in Square Kilometres

1990/2000

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 1990*
Tree Cover	194,605	10,957	2,358	3,101	-	211,020
Tree Cover Mosaic	1,573	136,285	9,072	4,492	-	151,422
Shrub Cover	125	2,471	170,638	12,775	-	186,009
Other Land Cover	17	1,061	5,150	327,828	279	334,333
Water	-	50	-	836	61,532	62,418
Total 2000	196,321	150,823	187,218	349,030	61,811	945,203

2000/2010

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2000*
Tree Cover	170,801	12,535	4,863	8,122	-	196,321
Tree Cover Mosaic	1,207	136,094	5,675	7,847	-	150,823
Shrub Cover	44	1,097	179,132	6,944	-	187,218
Other Land Cover	20	243	2,676	346,086	5	349,030.39
Water	-	-	-	46	61,765.23	61,811
Total 2010	172,072	149,969	192,346	369,046	61,770	945,204

2010/2015

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2010*
Tree Cover	169,018	1,156	883	1,014	-	172,072
Tree Cover Mosaic	169	147,726	353	1,721	-	149,969
Shrub Cover	121	1,010	189,551	1,665	-	192,346
Other Land Cover	63	1,485	957	366,538	2	369,046
Water	-	209	-	-	61,561	61,770
Total 2015	169,372	151,586	191,744	370,938	61,563	945,203

4.9.4. GIS of disturbances

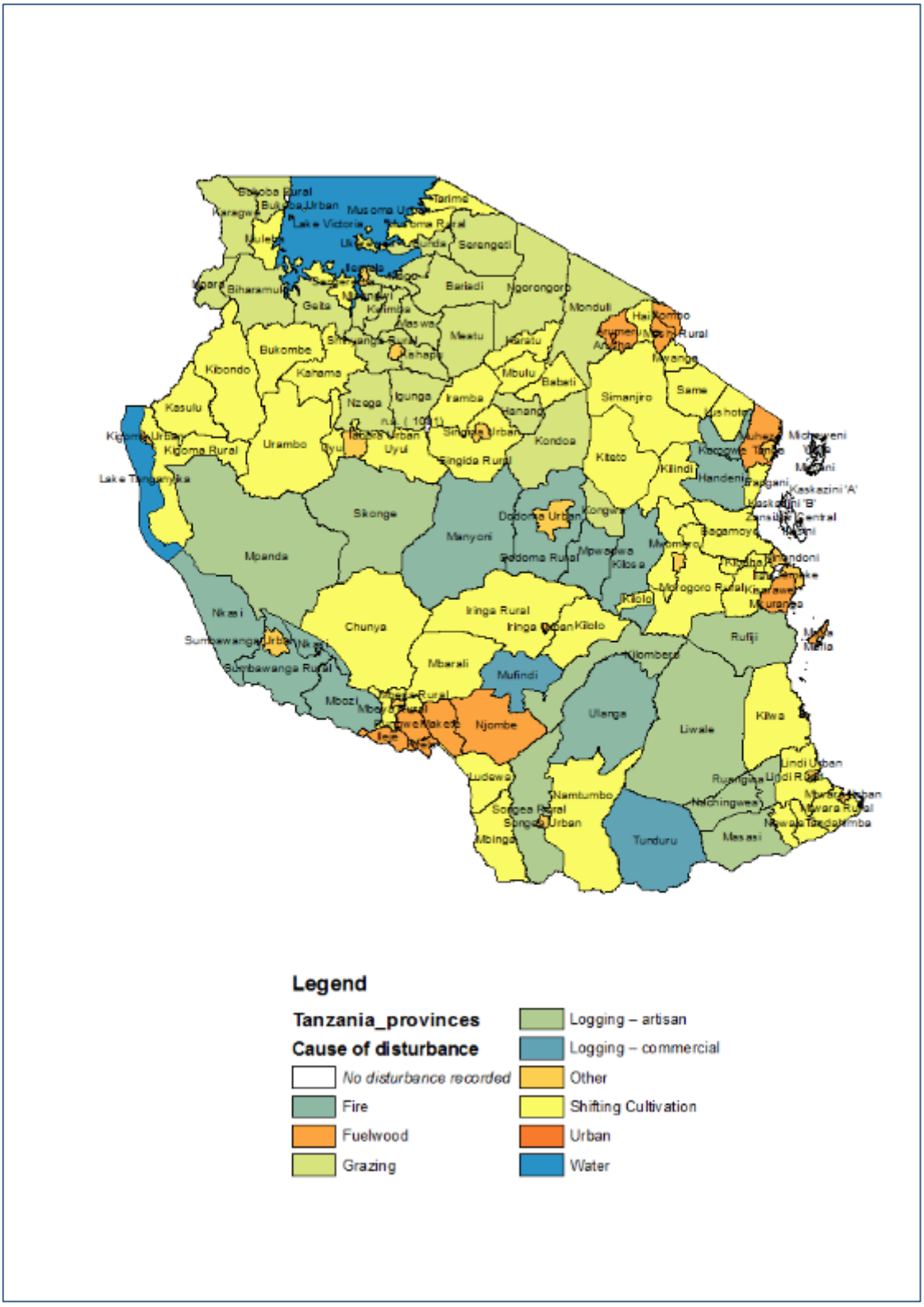


Figure 15: GIS for Tanzania

4.10. Uganda - John Diisi & John Bosco Nkurunungi

National Forestry Authority and Makerere University

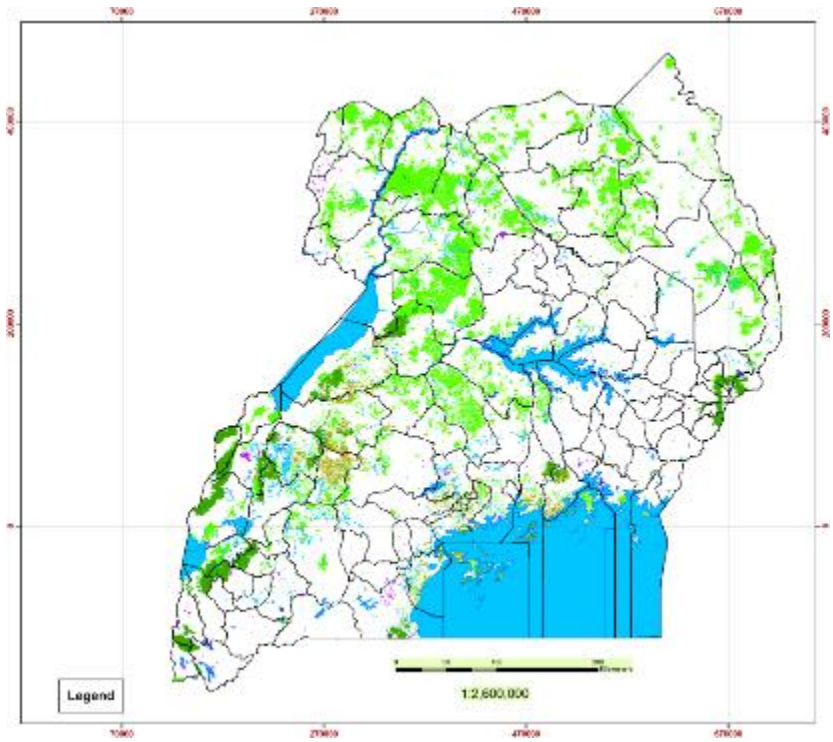
4.10.1. Overview

- **Forest definition:** Minimum tree crown cover of 10%; a minimum height of 4.0 metres and a minimum area of 0.5ha.
- **Deforestation.** Around 26,000 ha per year for dense and open tropical high forest. Woodlands are more seriously affected. However, there is an increase in broadleaf and coniferous plantations.

	Tropical High Forest		*Woodland*
	Dense	***Open***	
	(ha)	(ha)	(ha)
1990	*650,150*	*274,057*	*3,974,102*
2005	*616,307*	*187,420*	*2,719,102*
2010	*548,678*	*125,682*	*1,570,255*
2005 to 2010			
Loss (ha)	*67,629*	*61,738*	*1,148,847*
Annual loss (ha)	*13,526*	*12,348*	*229,769*
Annual Rate of loss	2.47%	6.59%	8.45%

- **The institutions** involved in forest monitoring and management: National Forestry Authority, which manages 506 Central Forest Reserves; Uganda Wildlife Authority, which manages forests in National parks and wildlife reserves; District Local governments for Local forest Reserves and helps people to manage their forests and Private tree farmers.
- **Deforestation and degradation drivers**: Demand for new land for Agriculture; Population increase; Demand for Firewood and Charcoal; Governance issues; Land take by Infrastructure development; Bush fires; Inappropriate land tenure system
- **Technical needs and requirements to help monitor deforestation and degradation:** Increase the number of actors involved in forest monitoring both Personnel and Institutions; Create linkages with other stakeholders eg UWA, LGs, Research, Academic institutions, CBOs, and the Private sector; Training of existing and new staff; Appropriate Equipment; Fast and reliable Internet connection; Licensed Software maintenance; Open Source software technical backstopping; Put in place a Forest information System

Capacity	Remote Sensing	GIS	Inventory
Basic information	Good	Good	Good
Technical capacities	Good	Good	Medium*
Human resources– skills and material (Numbers)	Medium*	Medium*	Medium (Bad)
Human resources for analysing data	Medium	Medium	Medium*
Software and computer resources	Medium	Medium	Bad*



Forest cover of Uganda

4.10.2. Country Fact sheet

Country Fact sheet	**Uganda**
Institution	National Forestry Authority
Other institutions involved in forest monitoring	Uganda Wildlife Authority
Specify type (Government / Research etc).	Government
Mandate of your institution	A. Management of the Central Forest Reserves Improved – targeting improved conservation of biodiversity, sustainable yield of forest products and environmental health through agreed plans, research, investments, and responsible management B. Partnership Arrangements Expanded – with a wide range of stakeholders, aiming at increasing the area of forest cover, responsible management of CFRs, new investments, benefit sharing, and efficient resource utilisation. C. Forest & Non-Forest Products and Services Supplied Equitably – aiming at providing both the public and private consumers, on commercial basis, with quality forest products, planting materials, forest services, and other non-forest products & services such as maps and technical advice, taking due consideration for the livelihoods of the forest adjacent communities. D. Organisational sustainability - include all aspects of sustainability required for an organization's stability that engenders environmentally conscious economic and social progress.
Institutional strengths	1. Government mandate 2. Experience and skills of staff 3. Institutional memory 4. Leading GIS capabilities in the country NFA is mandated to manage 1.2 million hectares of CFRs. Some of this forestland can be used to grow trees for cash, license private investment, and enter into joint arrangements to harness the immense investment opportunities. In addition, some of the CFRs are endowed with natural resources like timber stands, biological diversity, and an attractive rugged terrain suitable for tourism. The investment opportunities here are immense. 5. NFA is blessed with some of the best technical and professional staff. It will only invest in training and retooling of the staff to cope with the changing technologies. On policy and legal status, NFA is operating under a semi-

	autonomous framework which enables it to operate without the usual encumbrances associated with line government departments
Institutional weaknesses	
Specify (legal, technical , financial)	Legal-poor enforcement of the law, collecting of evidence, patrol Technical- New staff, mobility, poor or no internet Financial- low remuneration, funds for logistics
Specific areas to be addressed	1. Training of staff 2. Acquire Equipment 3. GIS software licences
Structural Capacity for:	
Field survey	Old equipment
Remote Sensing	Storage space, processing power and internet
GIS	Storage space, processing power and internet
Current RS data available	Remote sensing personnel in place National land cover datasets in place
Specify data source , coverage , dates	SPOT- 1990 Landsat 2005 Landsat 2010 Landsat 2015
Forest inventory data and maps	Inventory data in place but out-dated, There are stock maps for some forests where inventory has been done
Dates; coverage – regional , national	-Biomass inventory is national but was halted in 2008 due to lack of funding -Forest inventory is done per forest reserve
How were they produced?	ISMMI- Integrated Stock Survey and Management inventory
Review of forest information	
Forest types and distribution;	Tropical high forests- mostly in the west Woodlands- mid-central and north of the country
Forest protection	Central forest Reserve and National parks
Forest change (deforestation)	The rate was about 2% between 1990 to 2005
Forest change (degradation)	Not done
Main threats	Agriculture, and energy
Current REDD initiatives In the country	RPP approved and in place, implementation has started
Other initiatives	Forest Landscape Restoration and the Bonn Challenge in the

	ministry of Water and Environment is in its initial stages
Main types of forest degradation	Timber sawing> Charcoal and firewood production
Driving forces	Food production and Energy production
Current locations of forest degradation	
Location	Central and western Uganda
Source (logging / firewood etc,)	Agriculture, logging, and charcoal and firewood
Requirements for improving capacity Software , images, methodology	First internet, satellite images, faster computers of cloud computing, data storage, workflows to simplify land cover map production
Recommendations for the workshop	Improved workflows, training and access to cloud computing and storage.

4.10.3. Forest change statistics

Uganda

Area in Square Kilometres

1990/2000

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 1990*
Tree Cover	13,716	1,058	452	520	-	15,746
Tree Cover Mosaic	6	13,070	364	529	-	13,969
Shrub Cover	26	18	31,092	1,714	-	32,850
Other Land Cover	9	278	699	103,759	182	104,926
Water	-	-	6	22	32,191	32,219
Total 2000	13,757	14,424	32,613	106,543	32,374	199,710

2000/2010

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2000*
Tree Cover	12,008	780	355	614	-	13,757
Tree Cover Mosaic	744	11,878	787	1,015	-	14,424
Shrub Cover	-	34	29,660	2,919	-	32,613
Other Land Cover	57	32	801	105,654	-	106,543
Water	-	-	62	205	32,107	32,374
Total 2010	12,809	12,724	31,665	110,407	32,107	199,710

2010/2015

	Tree Cover	*Tree Cover Mosaic*	*Shrub Cover*	*Other Land Cover*	*Water*	*Total 2010*
Tree Cover	10,364.54	1,280	816	347	-	12,809
Tree Cover Mosaic	1,248	9,556	1,194	725	-	12,724
Shrub Cover	-	221	30,684	760	-	31,665
Other Land Cover	479	339	658	108,930	-	110,407
Water	-	-	10	4	32,093	32,107
Total 2015	12,092	11,396	33,362	110,767	32,093	199,710

5. Data provided to the countries

For most of the participant countries the JRC was able to provide high resolution (5m) RapidEye data. The participants were asked to select a forest area within each country.

Country	Area	Size (km²)	Licence #1:	Licence #2:	Licence #3:
Burundi	Kibra	500	JRC, Italy	RCMRD	Forestry Department
Ethiopia	Herrena	500	JRC, Italy	RCMRD	Min of Environment
Rwanda	Kagove	1000	JRC, Italy	RCMRD	Rwanda Natural Resources Authority
Somalia	Dinlaaba	598	JRC, Italy	RCMRD	Ministry Of Livestock, Forestry
South Sudan	Kinyatti	908	JRC, Italy	RCMRD	Ministry Of Agriculture, Forestry
Sudan	Alrawashda	524	JRC, Italy	RCMRD	Sudan Forest National Corporation
Tanzania	Itigi	3102	JRC, Italy	RCMRD	Tanzania Forest Service
Uganda/Kenya	Mount Elgon	3850	JRC, Italy	RCMRD	Kenya Forest Service / National Forestry Authority (Uganda)

Table 2: RapidEye data provided to the countires

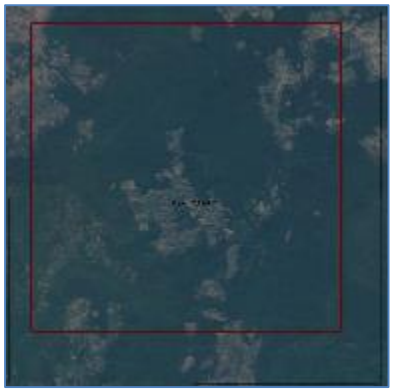
		
Burundi - Kibira	Ethiopia - Herrena	Kenya and Uganda - Mt.Elgon
		
Rwanda - Katove	Somalia - Dinlaaba	South Sudan - Kinyetti

Table 3: Examples of images provided

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Expert	Country	Affiliation

Appendices

JRC presentations on satellite data and methods

Satellite data for monitoring forest changes - Hugh Eva

Field data collection over Tanzania – Lorena Hojas

Regional Forest Monitoring by sampling – Marcela Velasco

JRC Production of data for regional monitoring – Hugh Eva

Land cover mapping with the IMPACT tool – Dario Simonetti

An assessment of the Global Forest Maps over Tanzania – Lorena Hojas

Training and practical sessions

The JRC Validation Tool – reviewing and correcting where necessary land cover classifications of national sample sites

Forest Monitoring– Introduction to JRC IMPACT tool: Installation and overview; Pre-processing Landsat data; Classifying and segmenting Landsat data; Validating land cover maps; processing RapidEye images.

Creating a GIS layer with degradation information at the national level with the IMPACT tool.

Oswald Ntakirutimana	Burundi	Forestry Department Min. of Environment
Yonas Tekleab Aymut	Eritrea	Forestry Department , Min. of Agriculture
Daniel Belay	Ethiopia	Min. of Environment and Forestry
Tariku Geda	Ethiopia	Min. of Environment and Forestry
Mohamed Ahmed Djibril	Djibouti	Ministère de l'Habitat, de l'Urbanisme et de l'Environnement
Anastase Nyandwi	Rwanda	Rwanda Natural Resources Authority
Simon Dralley Ambekye	South Sudan	Min. of Agriculture, Forestry, Cooperatives and Rural Development
Bronica Akol	South Sudan	Min. of Agriculture, Forestry, Cooperatives and Rural Development
Safaa Ahamed Beraima	Sudan	Sudan Forest National Corporation
Hanady Abdelgabbar	Sudan	Sudan Forest National Corporation
Abdi Osman Ali	Somalia	Min. of Livestock, Forestry and Rangeland
Ibrahim Abdi-nur Yakub	Somalia	Min. of Livestock, Forestry and Rangeland
Nurdin Chamuya	Tanzania	Tanzania Forest Service
Jared Elly Otieno	Tanzania	Tanzania Forest Service
Lorena Hojas	Italy	Consultant
Marcela Velasco	Colombia	Consultant
John Diisi	Uganda	National Forestry Authority
John Bosco	Uganda	Makerere University

List of overseas experts

List of Kenyan and international experts

Dr Esther Mwangi CIFOR
Dr Paolo Cerutti CIFOR
Dr Farah Hussein Director General RCMRD
D. Artan Gulied Director ICPAC
Mr Zachary Atheru MESA Project Manager ICPAC
Mr Muyambi Fortunate Forest Monitoring Thematic Expert ICPAC/RCMRD
Mr Mwangi Kenneth Remote Sensing Technician ICPAC/MESA
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